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THE DEVELOPMENT OF RELATIVE CLAUSES: COMPREHENSION STRATEGIES IN ENGLISH AND UKRAINIAN

by

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled THE DEVELOPMENT OF RELATIVE CLAUSES: COMPREHENSION STRATEGIES IN ENGLISH AND UKRAINIAN submitted by PATRICIA EVELYN LYNKOWSKY in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY in LINGUISTICS.

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This thesis is

dedicated to my parents,

Peter and Sophie Lynkowsky

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ABSTRACT

The aim of this study is to investigate the effects of three important language processing strategies, namely, the Interruption, the Word Order, and Parallel Function hypotheses, on the aquisition and comprehension of relative clauses. To this end four experiments were conducted, with evidence gathered from two languages: English, a relatively fixed word order language, and Ukrainian, a highly inflected language with relatively flexible word order. Children between the ages of six to eleven were tested in two separate experiments involving both English and Ukrainian, while the other two experiments provided adult normative data in English and Ukrainian.

The results of the two studies with children indicate that Interruption is the main factor affecting performance in English, while Word Order is the main factor in Ukrainian. The normative data obtained from both native and adult speakers of English and Ukrainian support the results of the comprehension studies conducted with Ukrainian children, indicating that Word Order is the main factor separating the four syntactic types tested. Although the factors affecting comprehension in English and Ukrainian children appear to differ, an examination of the errors committed by both groups reveals a great similarity in

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strategies. Both groups of children tend to depend on the linear order of constituents. The results also indicate that Sheldon's Parallel Function Hypothesis is not operative in the comprehension of relative clauses in the studies reported.

The evidence from English and UKrainian suggest that relative clause structures are interpreted in terms of their superficial form, suggesting that functional surface-oriented models of syntactic description are closer to providing insights into language acquisition and comprehension than models which place little emphasis on either functions or surface structures.

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TABLE OF CONTENTS

CHAPTER PAGE

1. INTRODUCTION....1
   1.1 Preliminaries....1
   1.2 The Role of Processing Strategies....2
   1.3 Aims....4
   1.4 Overview....6
2. PROCESSING VARIABLES....8
   2.1 Preliminaries....8
   2.2 Processing Factors....9
      2.2.1 Memory constraints....9
      2.2.2 Strategies....13
   2.3 Summary....18
3. EMPIRICAL STUDIES IN RELATIVE CLAUSE FORMATION....19
   3.1 Introduction....19
   3.2 Types of Research Evidence....20
      3.2.1 Evidence from production studies....20
         3.2.1.1 Antinucci and Parisi's study....20
         3.2.1.2 Limber's study....21
      3.2.2 Evidence from Imitation Studies....23
         3.2.2.1 Slobin and Welsh's study....23
         3.2.2.2 Sheldon's study....23
         3.2.2.3 C. Smith's study....24
         3.2.2.4 M. Smith's study....25
      3.2.3 Evidence from Comprehension Studies....26
         3.2.3.1 Brown's study....26

University of Alberta

3.2.3.2 Sheldon's study.....27
3.2.3.3 Legum's study.....29
3.2.3.4 Harada's study.....31
3.3 The Viability of the Parallel Function Constraint..32
3.4 A Critique of Sheldon's Error Analysis.....37
3.5 Conclusions.....42
4. EMPIRICAL TESTING OF THE HYPOTHESES.....44
4.1 The Hypotheses to Be Tested.....44
4.2 Independent Evidence for the Word Order Hypothesis.....48
4.3 Independent Motivation for the S>O Hypothesis.....53
4.4 Independent Evidence for the Verb/Object Proximity Hypothesis.....57
4.5 The Experiments.....60
4.5.1 Experiment 1: The English Study.....60
4.5.1.1 Design.....62
4.5.1.2 Subjects.....63
4.5.1.3 Materials.....63
4.5.2 Experiment 2: The Ukrainian Study.....63
4.5.2.1 Motivation.....63
4.5.2.2 Subjects.....68
4.5.2.3 Materials.....68
4.5.3 Experiment 3: English Normative Data.....68
4.5.3.1 Procedure.....69
4.5.4 Experiment 4: Ukrainian Normative Data.....69
4.5.4.1 Procedure.....69
4.6 Summary.....70
5. RESULTS AND DISCUSSION.....71

University of Alberta

5.1 THE EXPERIMENTS....71
5.1.1 Experiment 1: English Study....71
5.1.1.1 Summary of the Responses: Experiment 1....75
5.1.1.2 Error Analysis: Experiment 1....81
5.1.2 Experiment 2: Ukrainian Study....85
5.1.2.1 Summary of the Responses: Experiment 2....88
5.1.2.2 Error Analysis: Experiment 2....93
5.1.3 Experiment 3: English Normative Data....94
5.1.4 Experiment 4: Ukrainian Normative Data....96
5.2 Summary....98
6. SUMMARY....99
6.1 Introduction....99
6.2 The Role of Surface Cues in Comprehension....99
6.3 The Results of the Children's Data....100
6.3.1 The Conjoined Clause Analysis....104
6.3.2 The Adjacency Analysis....106
6.4 The Results of the Adults' Data....108
6.5 Interpretation of the Children's Results....112
6.6 Implications of the Results....121
6.7 Suggestions for Further Research....125
6.8 Conclusions....129
REFERENCES....132
APPENDIX A....142
APPENDIX B....143
APPENDIX C....144
APPENDIX D....147

University of Alberta

LIST OF TABLES

Table 1.1 Types of Relative Clause Structures 5

Table 3.1 Results of Sheldon's Study 29

Table 3.2 Deep and Surface Word Order 34

Table 4.1 English Relative Clause Types 46

Table 4.2 Predictions 47

Table 4.3 Ukrainian Relative Clause Types 47

Table 4.4 Predictions 48

Table 4.5 Four Types of Relative Sentences Tested in Ukrainian 65

Table 5.1 Analysis of Variance Results: Experiment 1. .72

Table 5.2 Newman-Keuls Test: Experiment 1 73

Table 5.3 Newman-Keuls Test: Experiment 1 74

Table 5.4 Number of Correct Responses by Age Group: English Data 77

Table 5.5 Distribution of Responses to SS Relatives. . 78

Table 5.6 Distribution of Responses to OS Relatives. . 79

Table 5.7 Distribution of Responses to OO Relatives. . 80

Table 5.8 Distribution of Responses to SO Relatives. . 81

Table 5.9 Analysis of Variance: Experiment 2 87

Table 5.10 Newman-Keuls Test: Experiment 2 87

Table 5.11 Number of Correct Responses by Age Group: Ukrainian Data 89

Table 5.12 Distribution of Responses to OS Relatives .. 90

Table 5.13 Distribution of Responses to SS Relatives .. 91

Table 5.14 Distribution of Responses to SO Relatives .. 92

Table 5.15 Distribution of Responses to OO Relatives .. 93

Table 5.16 Analysis of Variance: Experiment 3 96

Table 5.17 Newman-Keuls Test: Experiment 3 96

Table 5.18 Analysis of Variance: Experiment 4 97

Table 6.1 Summary of the Strategies: English Data. . 120

Table 6.2 Summary of the Strategies: Ukrainian Data..120

LIST OF FIGURES

Figure 6.1 Sentence Type by Age: English Data. . . 116

Figure 6.2 Sentence Type by Age: Ukrainian Data . . 116

CHAPTER ONE

INTRODUCTION

1.1 Preliminaries

One of the most interesting and important aspects of language acquisition is the child's development of the ability to produce and comprehend complex structures. Relativization, or relative clause formation, is an important feature of English syntax, but it has received relatively little attention in prior child language research, and although subordination is a basic, universal linguistic process, little is known about the actual acquisition of those complex structures which manifest this process, primarily because of the nature of the data base. Until recently, most claims about the acquisition of relative clause structures have been made on the basis of production data, which are of limited value if insight is sought into the full linguistic capabilities of the child. Consequently, relatively little is known about the nature of children's grammars, or about the relationship between the principles constraining child language and those constraining adult language. An investigation of the strategies employed in the comprehension of relative clause structures in various languages would not only enable us to provide a more precise characterization of these strategies,

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but would also afford us the opportunity to investigate the way in which the language processor[1] structures and organizes sentences containing embeddings. Such a study is one step in the program of testing the universality of language-learning principles and strategies that have been proposed by Slobin (1973), Bever (1970), and others.

1.2 The Role of Processing Strategies

In recent years there has been a shift in emphasis from a purely syntactic approach to language processing toward a more functionally oriented one, involving the view that comprehension is acquired through a system of processing strategies, whereby a hearer associates properties of surface structure with semantic information in a rather direct manner. Harada, Uyeno, Hayashibe, and Yamada (1976), for instance, claim that such strategies are heuristic procedures that "are either innate or . . . emerge at some distinct points during language development"(p. 202), and they therefore emphasize the importance of studying child language, since whatever grammatical system the child has internalized is presumably based on the linguistic data he has 'experienced' through these heuristic procedures or perceptual strategies (p. 202). Developmental psycholinguistic studies, then, should provide a rich data base for the study of comprehension strategies. Slobin

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[1] The notion of a 'language processor' will be used to refer to the individual involved in language production and reception, and not to a formal parsing device.

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(1973), for instance, has attempted to characterize some of the strategies and "operating principles" which he suggests govern language acquisition and comprehension. One such principle proposed by Slobin is the anti-interruption constraint (Universal D) which he formulates as: "Avoid interruption or rearrangement of linguistic units" (p. 199). Sheldon (1972), whose work on relative clause comprehension is probably one of the first important studies in developmental psycholinguistics to provide an empirical account of the role of perceptual strategies in child language development, has submitted Slobin's principle to empirical test and has argued that her results did not confirm Slobin's predictions about the difficulty of interruption and word order permutations for the language processor. Instead, she suggested that the Parallel Function Hypothesis was essential for explaining her results (1974, pp. 72-3). This hypothesis states that a complex sentence in which coreferential NPs have the same grammatical function is easier to process than a complex sentence in which the coreferential NPs have different grammatical functions (1972, p. 2).

Most of the studies on relative clause formation have utilized essentially four types of structures, each of which contains a single embedding. Depending on the grammatical function of the head NP and the relativized NP, the resulting four types of relative clauses are represented in

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Table 1.1 below. The first letter in each parenthesized pair represents the grammatical role of the NP on which the relative clause is formed (Subject or Object), while the second letter represents the grammatical role played by the relative pronoun within the relative clause (Subject or Object). Half of the sentences are self-embedded, with the relative clause on the subject NP, as in types SS and SO. These will be referred to as subject relatives throughout this dissertation. The other half of the sentences are right-branching, with the relative clause on the final NP, as in types OS and OO. These will be referred to as the object relatives. There are also two types of relative clause structures present in the representative structures - those in which the relativized NP functions as the subject of the relative clause (=SVO word order), and those in which it is the object (=OSV word order). Finally, in sentence types SS and OO, the relative pronoun shares the same grammatical function as its antecedent. The four sentence types, then, incorporate three syntactic variables: the position of the relative clause, the word order in the relative clause, and the grammatical function of the relative pronoun.

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1.3 Aims

The present study reports on four experiments. One extends Sheldon's comprehension experiment in which English-speaking children are instructed to move toy animals

Table 1.1

Types of Relative Clause Structures

1.	(SS):	NP [RP V NP] V NP
		The girl (that hit the boy) broke the doll.
2.	(SO):	NP [RP NP V] V NP
		The girl (that the boy hit) broke the doll.
3.	(OS):	NP V NP [RP V NP]
		The girl hit the boy (that broke the doll).
4.	(OO):	NP V NP [RP NP V]
		The girl hit the doll (that the boy broke).

in accordance with stimulus sentences of the type represented in Table 1.1 above, which were presented aurally. The second study replicates the experiment with Ukrainian-speaking children. Slobin's principles concerning interruptions and word order permutations are re-evaluated in light of a different data-base, and the viability of Sheldon's notion of a 'parallel function' constraint is also subjected to close examination. The other two studies, one in English, and one in Ukrainian, are designed to secure normative adult data on the relative naturalness of the various types of structures represented in Table 1.1. Some of the inadequacies of Slobin's Universal D are pointed out

and ways are suggested in which the proposal must be constrained if it is to be accepted as a viable language processing constraint. The main thrust of this research is to provide some characterization of the types of strategies that are employed by children who are beyond the two- and three-word stage of syntactic development, but who have not yet attained complete adult mastery.

1.4 Overview

Chapter Two discusses the effects of behavioral and developmental psycholinguistic variables on the acquisition and comprehension of sentences containing relative clause structures. In Chapter Three various imitation, production and comprehension studies are reviewed in order to highlight the problematic issues involved in the comprehension of relative clauses. The fact that the results from the comprehension studies involving relative structures do not necessarily reflect the predicted order of emergence of relative clauses in the speech of children is considered and some explanations are presented to account for the anomaly. A summary of the major issues is provided, along with an alternative hypothesis.

Chapter Four states the four hypotheses tested and describes the four experiments conducted, together with the design and motivation for each of the experiments. The results of the experiments are reported in Chapter Five. Chapter Six continues a discussion of the results of the

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experiments and the implications they have for the study of language processing strategies.

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CHAPTER TWO

PROCESSING VARIABLES

2.1 Preliminaries

This chapter is devoted to a review of the various studies that have addressed the processing variables affecting relative clause acquisition and comprehension. The first part of the chapter addresses the role of memory as a processing variable in the production and comprehension of self-embedded structures. Although the specifics of this issue remain somewhat vague, the results of research conducted in the area of relative clause comprehension suggest that there is a correlation between short term memory capacity and the ability to comprehend different types of syntax (Graham, 1968). It has been found, for instance, that the capacity of the child's primary memory increases as he grows older, and that the manner in which he stores information also changes (Mehler, 1974). Next, other developmental psycholinguistic factors are discussed which deal with the strategies and heuristics children employ in sentence parsing. Finally, on the basis of these developmental psycholinguistic principles, predictions are made about the expected order of emergence of relative clauses in the speech of children.

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2.2 Processing Factors

2.2.1 Memory constraints

The investigation of self-embedded structures has played an important role in contemporary linguistic and psychological studies. In English, self-embedding is represented in sentences such as the following:

2.1 The girl who is tiny lives in New York.

2.2 The boy the girl the man hated liked died.

Sentence (2.1) above exemplifies a single self-embedded sentence,[2] whereas sentence (2.2) is a multiply self-embedded sentence. On the basis of the structural complexity inherent in multiply self-embedded structures such as (2.2) above, Chomsky (1957) has argued that finite state systems are inadequate for the description of human language, and although linguistic theory allows repeated self-embedding, an automaton with a limited short term memory cannot process sentences with unlimited self-embedding (1963). As Miller and Isard clearly put it (1964):

> The fact that an indefinite number of self-embeddings is grammatical, yet at the same time psychologically unacceptable, would seem to imply that a clear distinction is necessary between our theory of language and our theory of the language user. (p. 294)

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[2] The terms self-embedded, center-embedded, and nested will be used interchangeably throughout this dissertation to refer to sentences such as (2.1) above.

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The difficulty associated with processing multiply self-embedded sentences was thus one of the key factors in formulating the distinction between competence and performance. Bever (1970) has also pointed out that

> either we must accept the current form of generative grammar as incorrect, since it cannot avoid generating center-embedded sentences in a natural way, or we must appeal to an unspecified perceptual strategy to account for its difficulty. (p. 334)

Chomsky and Miller (1963) have attempted to define such a perceptual principle and in so doing have attempted to shed some light on the nature of human memory. They suggest that a comprehension process may not interrupt its own operation more than once, primarily because it is difficult for the comprehension device to utilize a procedure while it is in the course of executing that procedure. Miller and Isard (1964) suggested that the difficulty is caused by interruption of a sub-routine for interpreting relative clauses: when confronted with a multiply self-embedded sentence, the hearer starts using his sub-routine; half-way through it he has to interrupt it to start again; and so on for each embedding.

More recently, self-embedded structures have played an important role in the formulation of perceptual or sentence processing strategies[3] (Bever, 1970), and in the suggestion of performance constraints on universal grammars (Kuno, 1971).

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[3]Throughout this dissertation the notion of 'perceptual' or 'processing' strategies will refer to those strategies employed by language users in sentence comprehension, not to sentence production.

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A number of experiments have been conducted in an attempt to determine which strategies are utilized in the processing of multiply embedded structures, but have shed little light on the issue of processing (parsing) strategies because of the highly unnatural character of such structures. Cook (1975, p. 205) concludes that the strategies used in the various experiments were a function of the particular experimental technique involved, and consequently could reveal little about the essential aspects of normal language processing. The variety of tasks employed is matched by the variety of explanations proposed to account for the results. Yngve (1960), for instance, suggested that the structure of embedded clauses tends to place an excessive load on the temporary memory used for speech processing. Miller and Chomsky (1963) agreed that memory limitations are involved, but disagreed about the importance of such structures. Finally, Bever (1970, p. 28) provided experimental evidence in support of a "sequential labeling strategy" of clause closure which states that "Any Noun-Verb-Noun (NVN) sequence within a potential unit in the surface structure corresponds to "actor-action-object." He argued that the sequential labeling strategy plus the general perceptual principle that "A stimulus may not be perceived simultaneously as having two positions on the same classificatory dimension" both contribute to the processing difficulty. Thus, in a sentence such as "The dog the cat was scratching was yelping," the dog is simultaneously the

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subject of was yelping and object of was scratching. This suggests that the presence of that would make the sentence easier to comprehend by providing cues as to the sentence structure. This prediction was confirmed by some experiments (Fodor & Garrett, 1967; Hakes & Foss, 1970), but not by others (Foss & Lynch, 1969). Schlesinger (1968) was able to show that the difficulty in understanding self-embedded sentences decreases when the predicate is pragmatically appropriate to its subject. The variety of explanations seems to suggest that many of the mental processes being tapped are only indirectly linked to normal comprehension. Furthermore, all the studies mentioned have dealt with the comprehension of multiply embedded relative clauses, which, as Stolz (1967) points out, are rare in normal speech and represent a new grammatical structure that has to be learned by the subjects in such experiments. Bever (1970) has hypothesized that the language processor never develops strategies for the perception of sentences which are not learnable, and that the speaker never acquires structures that are impossible to understand; consequently, certain aspects of sentence structure reflect the perceptual constraints placed on it by the child as he learns the structure, and by the adult as he utters it.

On the assumption that multiply embedded sentences are difficult for the adult processor because he has not developed strategies for interpreting these 'unnatural' structures, one could argue that by the same token single

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embeddings may seem equally unnatural to the child first learning them. If the difficulty in comprehending self-embedded sentences is, in fact, due to short term memory limitations, it is reasonable to expect that this property of linguistic structure would be difficult for the child language learner. Such a constraint would presumably affect the order of acquisition of relative clauses, and we would expect object relatives to emerge first by virtue of the fact that they contain no interruption of the main clause (cf. Table 1.1 above).

2.2.2 Strategies

Slobin (1971) has taken the position that certain predictions about linguistic development can be made on the basis of developmental psycholinguistic constraints. He presents evidence that cognitive or semantic development may be the true pacesetter in language acquisition, and that "the appearance in child speech of a new formal device serves only to code a function which the child has already understood and expressed implicitly"(1971, pp. 319-29). Slobin proceeds on the assumption that cognitive development precedes (exceeds) linguistic development, and that the order of development of cognitive structures is fairly consistent across languages regardless of the formal means available for expressing such concepts. Further, the more complex the linguistic device for expressing a certain notion, the longer it will take the child to achieve adult

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mastery of the device. He has proposed that children come to the task of language learning armed with pre-determined strategies which may or may not be compatible with the complexity of the formal structure being acquired. The child, then, is simultaneously acquiring two kinds of cognitive systems that relate to and interact with, but do not necessarily parallel each other. On the basis of cross-linguistic data, Slobin (1973) has proposed that one of the earliest strategies that a child brings to the task of grammatical development is the expectation that the order of elements in an utterance can be related to basic semantic relations, and he has posited the following universal constraint against interruptions, which operates in the processing of language and in the construction of grammars (p. 199): "Avoid interruption or rearrangement of linguistic units." In general terms, this principle states that interruption or rearrangement of linguistic units places an extra burden on sentence processing and that there is a tendency to preserve the internal or basic structure of linguistic units. Sheldon set out to investigate the evidence for such a universal which she formulated as the following empirical claim (1974, p. 274):

> A sentence with an interruption or rearrangement of linguistic units will be more difficult to process than a sentence that does not contain an interruption or rearrangement.

Slobin's proposed universal principle can now be interpreted in the form of two hypotheses that make testable predictions about the processing of relative clauses.

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THE INTERRUPTION HYPOTHESIS

Self-embedding contributes to psychological complexity.

THE WORD ORDER HYPOTHESIS

Subject-first (SVO) word order is easier to process than object-first (OSV) word order. (p. 2)

The Interruption Hypothesis claims that sentences containing nested clauses are more difficult to process than those containing non-nested clauses. Thus, sentences in which relative clauses modify subject NPs (SS and SO) should be more difficult to process than sentences in which the relative clauses modify object NPs (OO and OS), because the subject relative in the former types is nested within the matrix sentence and interrupts it. The Word Order Hypothesis claims that a surface sequence in which the standard word order has been preserved is easier to process than one in which the word order has not been preserved (Sheldon, 1977, p. 51). According to this hypothesis, sentences in which the object NP is relativized (SO and OO) will be more difficult to process than sentences in which the subject NP has been relativized (SS and OS). Implicit in Slobin's proposal, then, is the prediction that object relatives will be perceptually easier than subject relatives by virtue of the fact that there is no disruption of linguistic units in the main clause, and hence object relatives should be acquired earlier than subject relatives. The expected order of emergence of relative clause structures based on both of

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these two principles is the following: OS > OO , SS > SO.

In her research on the acquisition of English relative clauses, Sheldon (1974) argued that Slobin's interruption and word order hypotheses were not operative. In their place she proposed the Parallel Function Hypothesis, which can be formulated as follows:

THE PARALLEL FUNCTION HYPOTHESIS

A complex sentence in which coreferential NPs share the same grammatical function will be easier to process than one in which the coreferential NPs have different grammatical functions.

Sheldon's hypothesis, then, predicts the following order of emergence: SS, OO > OS, SO -- with no predicted difference between SS and OO or between OS and SO.

By formulating a set of developmental principles based on Slobin's cognitive prerequisites, Prideaux (1979a, 1979b) has provided a principled basis for predicting the order of emergence of relative clause structures in the speech of children. First, he points out the circularity that results from Slobin's definitions of formal and cognitive complexity: the cognitively simpler structures will emerge before cognitively complex structures, but those structures that emerge first might be accepted as simpler only by virtue of their earlier appearance. He resolves the circularity by appealing to a definition of cognitive

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complexity which is independent of language acquisition, namely that the cognitively simple structures are those which contain no embeddings and express those propositions in which the arguments are not themselves propositions (Prideaux, 1979a). Coordinate constructions are thereby rendered cognitively simpler and should precede embedded constructions in language acquisition in keeping with the principle of 'cognitive precedence.' Another principle of cognitive psychology which Slobin has adapted to psycholinguistic development can be called (after Prideaux, 1979b) the principle of 'functional expropriation', which states that new functions are first expressed by old structures. By applying the principle of cognitive precedence, Prideaux (1979b) predicted that conjoined structures will appear in advance of embedded structures. By applying functional expropriation, he predicted that conjoined stuctures (sentences, NPs, or VPs) will serve as prototypes for the earliest relative clauses. Finally, by applying a version of Slobin's principle of interruption, which he calls structural integrity, Prideaux argues that clause-final relatives should appear before clause internal ones. On the basis of these independent preditions, he argues that the order of emergence will be as follows: OO > OS > SS > SO.

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2.3 Summary

In this chapter we have reviewed some of the issues associated with the behavioral and developmental psycholinguistic factors of language acquisition and comprehension. Several studies have taken these aspects into account and have postulated competing predictions regarding the expected order of emergence of relative clauses structures in the speech of children, but as yet, no clear line can be drawn between order of acquisition and comprehension difficulties. Chapter Three provides a more detailed examination of these issues by presenting research evidence which bears directly on the problem of acquisition vs. comprehension.

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CHAPTER THREE

EMPIRICAL STUDIES IN RELATIVE CLAUSE FORMATION

3.1 Introduction

On the basis of developmental psycholinguistic principles, predictions have been made about the expected order of emergence of relative clauses in the speech of children (Sheldon, 1972; Slobin, 1973; Prideaux, 1979b). The extent to which these predictions are borne out by the actual acquisitional data reported in the literature will be discussed. However, the results from comprehension studies involving relative clause structures do not necessarily reflect the order of acquisition - that is, the relative order of ease of comprehension does not appear to correspond to the order of emergence of relative clauses in the speech of children. Some possibilities are then presented to account for this discrepancy and an alternative hypothesis is proposed. A critique of Sheldon's error analysis (1972) is presented, with particular emphasis on the inadequacies of her notion of a Parallel Function constraint operative in language processing. Finally, a summary of the problematic issues is presented.

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3.2 Types of Research Evidence

To date, most of the research evidence in the area of relative clause acquisition has come from three sources - naturalistic observations (C. Smith, 1970; Antinucci & Parisi, 1973; Limber, 1975), elicited imitation experiments (C. Smith, 1970; Slobin & Welsh, 1973; M. Smith, 1975), and comprehension studies (Brown, 1971; Cook, 1973, 1975; Sheldon, 1972, 1974, 1977; Legum, 1975; Harada et al., 1976). The results of these studies point to the fact that the difficulty in processing relative clause structures is due to the inherent complexity of the self-embedded structure per se; that is, nested or self-embedded clauses have the effect of interrupting the main clause, creating a source of difficulty for the child, whose short term memory capacity is less than is the adult's. Slobin's (1973) anti-interruption principle (Universal D) embodies such a constraint (see Chapter Two).

3.2.1 Evidence from production studies

3.2.1.1 Antinucci and Parisi's study

Antinucci and Parisi (1973) discovered relative clause constructions in the speech of their subjects as early as the end of the first year for the girl and the beginning of the second year for the boy. The entry of full object relatives into the children's speech was simultaneous with the entry of other clear cases of sentential embedding and was preceded by prenominal modifiers by about six months (in

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Sheldon, 1972, p. 14). Object relatives emerged first in both subjects.

3.2.1.2 Limber's study

Limber (1973) conducted a longitudinal study and found that conjoined structures emerged at 2;2. The first relative clauses appeared several months after the advent of conjunction and were formed on object NPs, with no evidence of formation on subject NPs. Only one type of relative appeared in Limber's data, namely type OO. Limber accounts for the striking absence of subject complexity (i.e., relativized subject NPs) in the early speech of children by appealing to linguistic, psychological, and communicative considerations. He suggests that the absence of subject complexity may be due to an anti-nesting constraint (1973):

> since nesting is a recognized factor complicating production and perception even for the fluent speaker, it is not surprising that children refrain from using nested constructions. (p. 183)

Limber proposes an alternative explanation:

> . . . pragmatic factors alone may suffice to explain the lack of relatives involving subject NPs. There is simply no opportunity for a relative clause in environments where the NP is typically a name or pronoun - hence no relatives on subject NPs. (p. 184)

On the basis of the data obtained from his naturalistic observations of children acquiring complex structures, Limber has suggested a reliance on the following strategy: "Do not apply syntactic operations to any subject NPs" (p. 182).

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Spontaneous production data have their limitations, however, as Chomsky (1964) has indicated:

> the child's actual verbal output is no more likely to provide an account for the real underlying competence in the case of the child language than in the case of adult language . . . . (p. 46)

Fraser, Bellugi, and Brown (1969) have also shown experimentally that comprehension ability in young children exceeds their production ability, although they hasten to point out that parents do not conduct controlled experiments to determine whether children really understand the grammatical forms of their parents' complex utterances, or whether they merely recognize certain words and assume the most likely grammatical relationship, using their knowledge of the real world.[4] Furthermore, they were unable to use their procedure with children younger than three. The experiment reported by Shipley, Smith, and Gleitman (1969) can be seen as another approach to making hypotheses about the listening strategies children use, although one of the major criticisms which could be leveled at the interpretations of the results is that the researchers were confounding the notions of 'grammaticality' and 'comprehensibility'. Despite the recognized limitations of spontaneous studies, some interesting facts have come to light, as indicated above.

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[4]Diarists such as Leopold (1949), and parents in general, consistently maintain that their children are able to understand more than they can say at every stage of language development.

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3.2.2 Evidence from Imitation Studies

Further evidence in support of the notion that self-embedding is a serious difficulty for the language learner comes from imitation studies.

3.2.2.1 Slobin and Welsh's study

Slobin and Welsh (1973) found that when their two-year old subject "Echo" was asked to repeat a complex sentence, she either omitted the relative clause, changed the complex sentence into a compound sentence, or restructured the main and subordinate clauses, placing the relative clause at the end of the sentence. Although the repetitions were grammaticaly correct, the types of changes made indicated that she understood the sentences correctly. Echo had no difficulty imitating conjoined structures, but was unable to repeat subject relatives correctly. Sentence length cannot be the source of difficulty, then, because some of her repititions were longer than the model. The fact that Echo was able to modify the surface structure and preserve the meaning of the utterance, but was unable to produce relative structures, points to the fact that it is the syntactic structure of the relative constructions that is the source of the difficulty.

3.2.2.2 Sheldon's study

Sheldon (1972) noticed that children did not always have difficulty imitating sentences with internal clauses.

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They were able to provide correct imitations if the subject relative clause was short (e.g., seven words), and if the verb in the relative clause was intransitive (p. 11). In their repetitions, subjects sometimes introduced a subject pronoun which repeated the subject NP, suggesting that there is a preference for having the subject next to the verb, but Sheldon detected a pause between the complex subject NP and the predicate, suggesting that the child processes the complex sentence as two adjacent clauses, rather than one clause interrupted by another. If Sheldon's observation is correct, by treating the complex NP as the subject, the child is biasing his input and constructing a sentence which contains no interruptions. Observations of this nature provide invaluable clues about the possible perceptual strategies children may be utilizing in processing complex sentences.

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3.2.2.3 C. Smith's study

In another repetition study, C. Smith (1970) found that three and four year olds had difficulty repeating subject relatives. The errors made by the subjects were interesting in that they occurred in the structurally complex part of the sentence. Smith also noted that because the constructions that were difficult contained complexity in both subject and object position, it is not the location of the complexity that is the source of the difficulty. She explains her results by appealing to the principle of

'compression', which states that the more information-carrying elements that are dominated by a surface NP or VP node, the more difficult the surface is to process (1970, p. 129). She states that

> . . . limitations on the memory and processing abilities of children account for the bound of compression, apparently; therefore, we may call it a mechanical constraint rather than a grammatical or notional one. (p. 131)

C. Smith, then, claims that compression is a property of surface structure, and tends to place limitations on children's memory rather than on their grammars.

3.2.2.4 M. Smith's study

M. Smith (1975) used an elicited imitation task in which 10 subjects aged 29-36 months were asked to imitate sentences containing relative clauses in which nonsense words were used "in order to minimize the effect of familiar noun on processing of the surface"(p. 107). His results do not directly support Sheldon's Parallel Function Hypothesis as applied to relative clause formation. The total means do, however, favour the NVN strategy (Bever, 1970) and the Minimal Distance Principle (MDP) (Rosenbaum, 1967). The MDP simply states that in a complex sentence such as John is eager to please, the NP nearest the verb (e.g., please) is interpreted as the subject of the verb. Smith consequently proposes a conjunction strategy in which the child inserts the conjunction "and" between the end of the main clause and the object relative clause, so that the subject of the main

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clause is interpreted as the extraposed subject of the embedded clause. His interpretation of the results is therefore based on the assumption that OS and SS relative structures are less complex than the OO and SO types because their superficial structures suit the NVN strategy, the MDP strategy, and hence a conjunct analysis. In short, the OS and SS types can be analyzed as conjoined simplex NVN sequences with coreferential subject NPs. That is, the OS and SS types are claimed, by M. Smith, to be interpreted as structures of the form [NP V NP and V NP].

Evidence from imitation studies indicates that interruptions are difficult for children. However, imitation does not necessarily reflect linguistic competence, for people can, within limits, imitate sentences they do not understand. Furthermore, if the child does interpret what he imitates, we have no way of knowing whether he assigns the stimulus the same interpretation as does the adult. Imitation data, then, provide limited information about the processing of relative clauses. According to Sheldon (1974), "the critical evidence for any claim about children's competence must come from a different type of data; that is, from facts about how children understand relative clauses" (p. 274).

3.2.3 Evidence from Comprehension Studies

3.2.3.1 Brown's study

Brown (1971) investigates the role of a) position of

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embedded relative clauses, b) grammatical functions of the relative pronoun, and c) the relative pronoun itself, in sentence comprehension. He used a picture identification task in which the subject was to indicate which of two pictures corresponded to a sentence read aloud. The subjects were 96 children divided into three equal groups of ages 3;0-3;9, 4;0-4;9, and 5;0-5;9. Brown found that the 3 year olds performed significantly worse than 4 and 5 year olds. With the 3 year olds, correct scores increased with age in months, which was not true of the older children. He thereby concluded that the 3 year olds were going through a critical period of relative clause development. Unfortunately Brown pooled the data, thereby obscuring developmental trends. He found no significant difference between the subject and object relatives, but did find a significant interaction between the position of embedding and the role of the relative pronoun. That is, sentences in which the relative pronoun functioned as subject of the relative clause were generally easier to comprehend than those in which it functioned as object. The relative order of ease of comprehension from easiest to hardest was: SS > OS > OO > SO. Brown's results, then, do not reflect any of the three predicted developmental orders suggested in Chapter Two.

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3.2.3.2 Sheldon's study

Sheldon (1972) used a toy-moving experiment to test the comprehension of children between the ages of 3;8 and 5;5 in

order to investigate the evidence for the Interruption Hypothesis, the Word Order Hypothesis, and the Parallel Function Hypothesis. The 33 children serving as subjects were divided into three equal groups, with ages (I) 3;8-4;3, (II) 4;6-4;11, and (III) 5;0-5;5. They were asked to move toy animals in accordance with instructions in sentences read by the experimenter. The four sentence types were controlled for three syntactic variables - the position of the relative clause, the word order in the relative clause, and the grammatical function of the identical NPs (for representative structures see Table 1.1). Sheldon's results do not confirm Slobin's predictions about the difficulty of interruption or word order permutation for the language processor. That is, children's performance on sentences with internal relative clauses did not differ significantly from their performance on sentences with final or object relative clauses. Furthermore, they did not make more errors on sentences which had the subject NP relativized than they did on sentences which had the object NP relativized. As with Brown's subjects, performance increased with age. Although there was no significant effect of relative clause position, there was an interaction between position of embedding and relative pronoun function. More specifically, while the SS and OO structures did not differ significantly in ease of comprehension, nor did the OS and SO structures, the pair (SS+OO) was significantly easier to comprehend than the pair (OS+SO). Sheldon attributes this result to what she terms

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Table 3.1 Relative ease of each type of structure (with mean number of correct answers for each, out of 3 possible) for each age group (from (Sheldon, 1974)

Age Group	Relative Ease (Mean Correct)
I (3;8-4;3)	OO (1.36) > SS (1.00) > OS (.54) > SO (.18)
II(4;6-4;11)	OO (1.64) > SS (1.45) > OS (.91) > SO (.73)
III(5;0-5;5)	SS (2.27) > OO (1.55) > OS (1.17) > SO (.64)
Average Mean Score:	SS (1.58) > OO (1.52) > OS (.88) > SO (.52)

the 'parallel function' constraint, which states that structures like OO and SS, in which the relative pronoun plays the same grammatical role in the relative clause as its antecedent NP in the matrix clause, will be easier to comprehend than structures in which the relative pronoun and its antecedent serve different functions. Her results, in terms of the relative ease of each structure (mean number of correct responses for each) for each age group are represented in Table 3.1.

3.2.3.3 Legum's study

Sheldon (1977) reports that Legum (1975) replicated the

toy-moving experiment using monolingual English-speaking subjects ranging in age from 6 to 8 years of age and found that there was no reliable effect of age (Sheldon, 1977, p. 77). Also, there was no significant main effect for embedding; performance on sentences with nested clauses (SS and SO) was not significantly different from performance on sentences with final relative clauses (OS and OO). Performance on parallel function relatives (OO and SS) was significantly better than performance on nonparallel function relatives ($p < 0.01$). Legum's results, then, replicate Sheldon's findings for a different age range. His results support the Parallel Function Hypothesis and indicate that the 'parallel function constraint' operates in acquisition as late as 8 years of age. The only difference between Sheldon's younger group and Legum's older group was in how their performance was affected as a function of which NP is relativized, for Legum found that sentences with relativized subjects (SS and OS) were significantly easier than sentences with relativized objects (SO and OO). This variable seemed to have no effect on the performance of the younger group, although there was a trend in the 5 year old group in favor of sentences with relativized subjects. Thus, the variable of word order in the relative clause appears to be an age-related factor, according to Legum's results: it does not appear to play an important a role in younger children's comprehension of English, but is relevant to older children (1977, p. 55).

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3.2.3.4 Harada's study

Harada et al. (1976) carried out an experiment on the development of Japanese children's comprehension of relative clause constructions. They concluded that of the several hypotheses proposed to account for the imbalance of performance of the four relative clause structures, only Slobin's Interruption Hypothesis has the potential of being a universally valid account. Although it correctly predicts that center-embeddings will be more difficult than right-branching structures, it fails to account for success on the SS structures (i.e., a structure containing an interruption of the main clause). In an attempt to account for such an anomaly, Harada et al. invoke the Juxtaposition Hypothesis (JH), which predicts that complex sentences are analyzed as a juxtaposition of two clauses with a shared subject; consequently, it predicts that the English constructions of the SS type will be perceptually optimal because they can be understood correctly if the relative pronouns are ignored. Harada et al. also argue that the JH accounts for the majority of errors observed in Sheldon's study, whereas Sheldon attributes the large number of errors on the OS relatives to an over-reliance on the "extraposition" and parallel function strategies.

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3.3 The Viability of the Parallel Function Constraint

Sheldon's notion of a 'parallel function' constraint operating in language acquisition makes reference to the grammatical functions of underlying coreferential NPs and to their structural configurations (1972, p. 23). This position is unconvincing because of the circularity involved. If the child has access to information about the underlying grammatical functions of the coreferential NPs, then it is unnecessary for him to rely on a parsing strategy which assigns the very grammatical relations he already knows. Consequently, given such an interpretation, it is difficult to argue that children employ the 'parallel function' strategy in parsing relative clause structures.

Sheldon admits that the inception of the 'parallel function' constraint was inspired by Bever's (1970) notion of a 'double function' constraint operating in perceptual strategies, but she goes to great lengths to point out the differences between the two concepts (1972):

> parallel function refers to the grammatical functions that coreferential NPs have, to their structural configurations. The function of an NP is specified by the rules of the grammar and not by a perceptual strategy . . . however, according to Bever, double function is specified by the double application of a strategy that interprets surface structures and not by underlying grammatical relations of the coreferential NPs, (p. 72)

In view of the fact that the child's task is to impose a structure on the utterances he hears, surface rather than derivational considerations would seem the more plausible vehicle for comprehension. It would be difficult to explain

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how a child would proceed to assign underlying grammatical functions to structures he is in the process of acquiring, even within a data-analytic framework.

A crucial consideration which Sheldon failed to take into account in motivating her 'parallel function' strategy is the role of actives and passives within her analysis. The critical consideration of whether the Parallel Function Hypothesis is defined on deep or surface grammatical relations has serious implications for the analysis. If the Parallel Function Hypothesis is defined either on deep or on surface cases, the introduction of passives forces the Parallel Function Hypothesis to yield predictions which are intuitively incorrect as demonstrated below. Consider the following sentences:

3.1 The boy (that was chased by the dog) saw the man.

3.2 The man saw the boy (that chased the dog).

3.3 The boy (that the dog chased) saw the man.

3.4 The boy (that the dog was chased by) saw the man.

Each of these sentences has a deep and a surface word order, in terms of deep and surface subject and object. Consequently, the question of the 'parallel function' can be raised at either the deep or surface level. Table 3.2 provides the deep and surface word order for each of the four sentences.

If the Parallel Function Hypothesis is defined on

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Table 3.2 Deep and Surface Word Orders

Sentence	Deep Word Order	Surface Word Order
3.1	S[OVS]VO	S[SVO]VO
3.2	SVO[SVO]	SVO[SVO]
3.3	S[OSV]VO	S[OSV]VO
3.4	S[SOV]VO	S[OSV]VO

surface relations, then (3.1) should be easier than (3.2), since (3.1) has a surface parallel function, but (3.2) does not. However, this is an implausible prediction. If the Parallel Function Hypothesis is defined on deep relations, on the other hand, then (3.4), which has deep parallel function, should be easier than (3.3), which does not. This is also an incorrect prediction. Since the Parallel Function Hypothesis cannot be plausibly defined on either deep or surface relations, then either (a) passive sentences must be excluded from the domain of the parallel function hypothesis, or (b) the hypothesis is falsified, or (c) the judgements are incorrect. Since (a) weakens the Parallel Function Hypothesis greatly and in an ad hoc manner, then (b) must be the preferred choice, on a priori grounds.

In order to evaluate the hypothesis empirically, a

psycholinguistic experiment was conducted in order to obtain judgements as to the relative ease or "naturalness" of all the sentence types in question (Prideaux et al., 1979). Naturalness judgements were elicted for all types of both active and passive relative clause structures. The results of the study refute Sheldon's Parallel Function Hypothesis regardless of whether it is defined on deep or surface structures. That is, the Parallel Function Hypothesis cannot be defined either on deep or surface relations, for once voice is introduced as a variable, the Hypothesis is falsified. Within the actives, interruption was found to be the only significant factor. In the passives, only relative clause word order was found to be important, with a preference for those passivized relative clauses which preserve the surface word order of (SVO) as opposed to (OSV).[5]

It is odd that Sheldon invokes generative transformational concepts to explain some phenomena but not others. For example, her notion of a 'parallel function' is based on a transformational generative approach to linguistic analysis; yet, she does not treat relativization per se in the same vein. The relativization rule in a generative grammar applies wherever the structural description is met; consequently, relative clauses should emerge on all NPs at the same time, since the structural

---

[5] It is interesting that in reporting her study, Sheldon found that her results did not confirm Slobin's predictions about either the difficulty of interruption or word order permutations for the language processor.

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configurations for relative clauses do not specify which surface NP can or can not take a relative clause. In her study, however, Sheldon does take into account the cognitive functional aspects of relative clause acquisition.

Prideaux (1979b) provides a functional explanation for the apparent ease of comprehension of the parallel function relatives, explaining that the SS structures can be modeled on conjoined structures containing a compound NP subject, while the OO structures are modeled on conjoined clauses. The fact that OO structures are mastered before the SS structures is to be expected if the former conjoined clauses precede conjoined phrases in order of emergence. The interesting question yet to be answered is why the OO types are produced first.

Another suspicious aspect of Sheldon's analysis concerns the statistical evidence in support of the 'parallel function' constraint. She reported that although the SS and OO structures did not differ significantly in ease of comprehension, nor did the OS and SO structures, the pair (SS+OO) was significantly easier to comprehend than the pair (OS+SO). This is not surprising, for the scores on the OO type relatives were by far the highest at the outset. By pooling the high scores of the OO type relatives and the scores on the SS relatives, one would expect the sum to be high, and therefore it is not surprising that the results of (SS+OO) are significantly higher than (SO+OS), where both scores tended to be low anyway. For these reasons the

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'parallel function' heuristic is highly suspect as a language-independent processing strategy, and as pointed out by Prideaux (1979b), "it merely names the result without explaining it" (p. 37).

3.4 A Critique of Sheldon's Error Analysis

A significant aspect of Sheldon's study is her analysis of the errors made by the subjects. Sheldon found that performance on subject relatives improved greatly with age, but that performance on object relatives improved much less in comparison, which is to be expected if the object relatives are first to emerge. Further, she found that the children were consistently interpreting the object relatives as modifying the main clause subject NP. Sheldon takes this as evidence of the fact that the child has overlearned a transformation of extraposition (1977):

> . . . the children have a rule of Extraposition from NP which moves an internal relative clause to the end of the main clause, and they over-rely on this rule to interpret any relative clause at the end of the main clause as if it had been part of the subject in deep structure and was transported by the Extraposition rule to sentence-final position. (p. 64)

Sheldon cites the following as an instance of this phenomenon, whereby the child "extraposed" the relative clause in her repetition, but moved the toys correctly (1972, p. 55):

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Given: The giraffe (that bumps into the lion) stands on the horse. (SS)

Repeated: The giraffe bumps into the lion that stands on the horse. (OS)

Acted: The giraffe bumps into the lion / the giraffe stands on the horse. (SS)

Yet the object relatives were among the best comprehended. Furthermore, this account is difficult to reconcile with the fact that her results show no significant difference between comprehension on self-embedded and right-branching structures. It is thus curious that a child who encounters no difficulty in processing self-embedded sentences would resort to a strategy which presumably facilitates processing by extraposing the internal clause to sentence-final position, essentially making all relatives right-branching. More surprisingly, Sheldon uses this as evidence against the interruption constraint:

> . . . since the use of the Extraposition strategy by both English and French children indicates the systematic avoidance of continuous constituents and the favouring of discontinous constituents, the French acquisition data, like the English data, falsifies Slobin's claim that children will use strategies of speech perception which prohibit interruption of linguistic units. (p. 65)

She also states that

> both English and French speakers prefer to associate a relative clause with an adjacent NP whenever possible, even in cases where it can be associated with either NP. (p. 64)

Despite the contradiction that appears in Sheldon's account,

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it can be argued that such an interpretation of 'extraposition' errors is, in fact, a misnomer, for it directly reflects a distinctly transformational notion of movement rules. It can be argued that the so-called "extraposition strategy" is a consequence, not a cause, of the child's syntactic development. If the child's first experience with relatives is predominantly with object relatives, a reasonable conjecture is that when exposed to a subject relative, the child overgeneralizes on the basis of the more familiar object relatives, placing the subject relative in sentence-final position, even though he may be well aware that it modifies the subject NP. Such an explanation is supported by the fact that some of Sheldon's subjects repeated the subject relatives incorrectly but performed the task correctly. This placement of all relative clauses in sentence-final position can be analyzed simply as an overgeneralization of a principle the child has deduced on the basis of his experience with the object relatives and is quite predictable for a particular developmental stage in relative clause acquisition. For this reason, it is not surprising that children do not find sentences such as the one below ambiguous, whereas adults do:

3.5 A guy was dating my sister who lives in Montreal.

At one stage the child construes the relative as modifying only guy; later, he, too, finds it ambiguous. Kimball (1973)

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proposes a strategy which adults supposedly utilized in dealing with interruptions. He suggests that if a discontinuous constituent is interrupted by too long a stream of speech, or if the main clause is interrupted by an embedded clause, the listener tries to minimize memory load by relying on the following strategy: "Try to attach each new word to the constituent that came just before" (Kimball, 1973). Such a strategy would render the above sentence ambiguous for the adult, but not for the child, whose perceptual strategy is not dependent on a similar constraint. The preferred adult analysis, in fact, is the OS interpretation, based on Kimball's predictions.

Finally, an "extraposition error" on an SS relative would lead to a correct interpretation, which likely accounts for Sheldon's high percentage of such errors (81%) on SS relatives (1972, p. 52).

An obvious reason why subject relatives would be more difficult to process than object relatives is due to the fact that the interruption of a main clause by an embedded clause creates an adjacent surface sequence of nouns and verbs that appear to be constituents of a clause:

(SS) The giraffe that bumps into the lion stands on the horse.

(SO) The lion that the horse bumps jumps over the giraffe.

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Sheldon found that the most frequent and consistent mistake made on both types of subject relatives was due to the child's inability to find the boundary of the relative clause.[6] Consequently children would interpret (3.6) below as (3.7):

3.6 The lion that pushes the horse knocks down the cow.

3.7 The lion pushes the horse and the horse knocks down the cow.

In so doing, the children were apparently relying on what Sheldon refers to as an Adjacency strategy (1977):

> . . . in parsing a noncompound sentence, starting from the left, group together as constituents of the same construction two adjacent NPs (i.e., not separated by other NPs) and an adjacent, noninitial verb that has not already been assigned to a clause. Interpret the first NP as the subject of the verb, a and the second NP as the object of the verb. (p. 65)

According to Sheldon's explication of this strategy, two adjacent NPs do not have to be contiguous, and the relative pronouns do not "count" as NPs. Sheldon reports that the most frequent and consistent error on the three sentence types, SO, OO, and SS, was an 'adjacency error'. She neglects to mention, however, that this strategy will correctly parse only the OS relatives; consequently even 'errors' will count as correct interpretations in this last situation.

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[6] Sheldon (1972) concluded that children apparently were not using either intonation or the relative pronoun as clues for finding the boundaries between the interrupting relative clause and the main clause (p. 72).

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Another common error in the responses of Sheldon's subjects was the interpretation of the relativized nominal in the SO relatives as the subject, which Sheldon has referred to as the FNS strategy or FIRST-NOMINAL-IS-THE-SUBJECT-STRATEGY. This strategy was particularly common with the younger subjects and its use decreased markedly with an increase in age. Sheldon, then, explains most of the errors (i.e., other than those considered to be random errors) as an over-reliance on either the Extraposition strategy, the Adjacency strategy, the Parallel Function strategy, the FNS strategy, or some combination of the above.

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3.5 Conclusions

Although the results of comprehension studies do not directly illuminate the problem of the order of acquisition of relative clause structures, they do reveal that the governing principles discussed above play an important role in explaining the relative difficulty of comprehension of the different structures. The results of this review, then, point to the following questions which remain unanswered:

1. The research evidence from the comprehension studies and the production studies is equivocal, with the comprehension results in conflict with those of the spontaneous production studies. This lack of consonance

between the results remains to be resolved.

2. It was found that word order within the active relative clause had no significant effect on comprehension. Yet, there was some indication that the ability to process word order was an age-related factor. To what extent, then, does word order within a relative clause affect the ease of comprehension?
3. Finally, what particular aspects of the surface structure facilitate processing, making some structures more difficult to comprehend than others? What precisely is the processor attending to? Is it the SVO word order and/or the proximity of the verb and object? Is it the ordering of the subject before the object that is crucial, or is the position of the verb relative to the subject and object the issue?

In order to illuminate these complex issues further, additional experiments dealing with relative clauses were conducted with the specific aim of testing the interruption hypothesis and three distinct versions of the word order hypothesis. Comprehension data from two different languages were gathered to this end. These experiments are discussed in the following chapter.

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CHAPTER FOUR

EMPIRICAL TESTING OF THE HYPOTHESES

4.1 The Hypotheses to Be Tested

The aim of this study is to provide additional evidence, both from acquisition and adult language comprehension, concerning the various competing claims made by the interruption hypothesis and different versions of the word order hypothesis. Slobin's (1973) interruption hypothesis can be stated as:

> THE INTERRUPTION HYPOTHESIS
>
> Sentences in which the nested clauses interrupt the matrix sentence are more difficult to process than sentences in which there is no interruption of the main clause (OS, OO > SO, SS).

The word order hypothesis, as discussed in Chapters Two and Three, can be dissected into three distinct versions. One version, a more "global" statement, simply states that the basic word order (e.g., SVO, etc.) is to be maintained in a Gestalt manner, and any violation disrupts comprehension. However, two other versions are also possible. One states that the relative position of subject

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and object must be maintained, independent of the location of the verb in order to facilitate comprehension, while the second version claims that the verb and object must be contiguous, regardless of order and regardless of the position of the subject. These three versions of the word order hypothesis can be stated as follows:

THE WORD ORDER HYPOTHESES

a. THE SVO HYPOTHESIS

Relative clauses which retain the basic SVO word order are more easily comprehended than clauses in which the SVO word order is disrupted, (e.g., in relative clauses, SVO > SOV, OSV, OVS).

b. THE SUBJECT-OBJECT HYPOTHESIS

Sentences with relative clauses in which the subject precedes the object are easier to process than sentences where the object precedes the subject (e.g., in relative clauses, SOV, SVO > OSV, OVS).

c. THE VERB-OBJECT PROXIMITY HYPOTHESIS

Sentences containing relative clauses in which the verb and object are separated will be more difficult to process than those in which the verb and object cohesiveness is retained (e.g., in relative clauses, SOV, SVO, OVS > OSV).

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This chapter is devoted to an examination of those three hypotheses. First the different predictions of each version of the word order hypothesis are discussed. Next, independent motivation is offered for each version of the word order hypothesis. Finally, a set of experiments is proposed to test each of the hypotheses. Each experiment is motivated by relating it to previous studies and each is detailed in terms of design, subjects, and stimulus materials.

It should be noted that the Word Order Hypotheses (a), (b), and (c) are not differentiated in the predictions they make about the ease of comprehension of relative clause structures in English. There are only two possible word orders in English relative clauses - namely (SVO) and (OSV) as represented in Table 4.1.

Table 4.1 English Relative Clauses

Relative Clause Types in English	Word Order	Sentence Types
1.Relativized subject: NP [RP V NP]	(SVO)	SS and OS
2.Relativized object: NP [RP NP V]	(OSV)	OO and SO

On the basis of the three word order hypotheses, the predictions in Table 4.2 follow. All three versions of the

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Table 4.2 Predictions

Hypothesis		Predictions
Hypothesis (A):	THE SVO HYPOTHESIS	1 > 2
Hypothesis (B):	THE SUBJECT-OBJECT HYPOTHESIS	1 > 2
Hypothesis (C):	THE VO PROXIMITY HYPOTHESIS	1 > 2

Word Order Hypothesis make the same predictions for English relative clauses. In Ukrainian, however, the required NP morphology allows for more flexibility in word order. Consequently, these hypotheses make different predictions about the relative degree of ease of comprehension. Each of the two relative clause types cited for English has two variant word orders in Ukrainian; thus, the word orders represented in Table 4.3 are all possible in Ukrainian relative clauses, where the relativized subject type (1) has the two variants (a) and (b), and the relativized object type (2) has the variants (c) and (d), as represented in Table 4.3.

Table 4.3 Ukrainian Relative Clause Types

	Relative Clause Types	Word Order	Sentence Types
(1)	a. NP [RP V NP]	(SVO)	SS and OS
	b. NP [RP NP V]	(SOV)	SS and OS
(2)	c. NP [RP V NP]	(OVS)	OO and SO
	d. NP [RP NP V]	(OSV)	OO and SO

On the basis of the three competing hypotheses, the predictions of the relative difficulties of (a), (b), (c), and (d) of Table 4.3 can be formulated as in Table 4.4.

Table 4.4 Predictions

Hypothesis		Predictions
Hypothesis (A):	THE SVO HYPOTHESIS	a > b,c,d
Hypothesis (B):	THE SUBJECT-OBJECT HYPOTHESIS	a,b > c,d
Hypothesis (C):	THE VO PROXIMITY HYPOTHESIS	a,b,c > d

This chapter reviews the evidence associated with each of the hypotheses presented at the beginning of this chapter and then presents a formulation of each of the four experiments conducted, along with the motivation and a description of the experimental technique employed for each.

4.2 Independent Evidence for the Word Order Hypothesis

As mentioned above, the second hypothesis tested by Sheldon (1974) and Legum (1975) (in Sheldon, 1977) is the Word Order Hypothesis, which claims that a surface sequence in which the underlying word order has been preserved is easier to process than one in which the word order has been disrupted. According to this hypothesis, sentences in which the object NP is relativized and consequently fronted within the relative clause (SO and OO) will be more difficult than

sentences in which the subject NP has been relativized (SS and OS), and thus a sentence such as (4.1) below should be easier to process than (4.2):

4.1 The boy who hit the girl kicked the dog.

4.2 The boy who the girl hit kicked the dog.

Presumably this is because, according to the standard transformationalist treatment of relativization, the underlying word order is preserved in the surface structure of the relative clauses in which the subject NP is relativized.

However, independent empirical evidence for a word order strategy can be found. Experimental data from studies on children's interpretations of passive sentences, for example, revealed a tendency to interpret word order in terms of functional relations: Noun-Verb-Noun sequences are decoded as actor-action-patient structures (Slobin, 1966; Bever, 1970). It was the results of such studies that prompted Bever to suppose the existence of perceptual strategies such as: "Any NVN sequence within a potential internal unit in the surface structure corresponds to actor-action-object" (Bever, 1970). Further, proceeding on the assumption that 3 and 4 year old subjects would treat deviant utterances in terms of their own constraints on well-formedness, Sinclair and Bronckart (1972) asked French-speaking children between the ages of 2;10 and 7;0 to

University of Alberta

act out deviant three word utterances consisting of two nouns and a verb in its infinitival form. They found that the choice of strategy employed by the children was a function of their age, and that the developmental trend was clearly toward a strategy in which the relative position of the two nouns determined the interpretations: the first noun was consistently taken to be the subject, and the second noun the object. An interesting aspect of the study was the analysis of how strategies changed with age. The youngest group first located the verb and then interpreted the nearest noun as the agent. The middle group (4;11-5;11) located the verb and interpreted the noun nearest the verb as the patient. The oldest group interpreted the first noun as agent, and the second noun as patient, regardless of the position of the verb. In fact, it was found that around the age of seven, the pattern NVN=AG AC PA seems to be extraordinarily forceful even to the extent that the conflict between the structural and the pragmatic constraints often resulted in a refusal to act. Sheldon (1972) claims that older children usually give subject status to the first NP because they have more language experience than younger children and are assuming that the subject comes first on the basis of the high frequency of the SVO word order in declarative sentences (p. 21). This corresponds to Greenberg's (1963) observation that in the languages he examined, the surface word order in declarative statements usually has the subject preceding the object.

University of Alberta

There are attestations to the fact that word order overrides morphological considerations in language acquisition and comprehension. Although Russian is a highly inflected language, Slobin (1966) found that Russian children first adopt a fixed word order and learn the morphological markers later. Similarly, Roeper (1972) reports that German children prefer an ordering of indirect object before direct object. Sentences with the order of direct before indirect object were often understood as if the order was indirect before direct, even though the article in German is inflected for the grammatical function of the NP. When asked to imitate sentences with the NPs in the order of direct before indirect object, children tended to switch the articles in their imitation, placing the article for the indirect object with the first NP and the article for the direct object with the second NP.

Further support for the child's reliance on a word order strategy can be found in interpretations of cleft sentences in English. Bever (1970) and Sheldon (1972) found that children interpret object cleft sentences such as (4.3) below to mean (4.4):

4.3 It's the lion that the giraffe kicks.

4.4 The lion kicks the giraffe.

whereas they had no difficulty understanding subject cleft sentences such as:

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4.5 It's the lion that kicks the giraffe.

Ervin-Tripp (1970) reports that children will interpret object questions, where the questioned object NP appears in surface subject position, such as Who did John see? as meaning Who saw John? They did not, however, encounter any difficulties with subject questions.

In these languages, then, linguistic constructions that constitute an exception to the SVO word order are difficult to process because they are interpreted as examples of standard word order. Additional evidence was reported by Legum (1975), who found that adults, as well as children, often over-rely on word order strategies in processing their native language. Legum tested monolingual French speakers between the ages of four and ten using Sheldon's toy-moving procedure. The French sentence types differed from the English in two respects. First, the French relative pronoun varies in its form according to its function in the relative clause - the form for the relativized subjects is qui and for objects the form is que. Consequently, the function of the relativized NP is marked overtly and word order should not be crucial for the correct interpretation of the clause. Error analysis revealed, however, that the subjects were making SVO errors, allowing word order to override morphological markings. Another aspect in which French differs from English concerns the word order within the relative clause: French has an optional 'rule' of subject

University of Alberta

postposition which places the subject NP in an object relative clause behind the verb. One would expect that since both (4.6) and (4.7) below are considered to be stylistic variants, the language learner would not have any difficulty, because the presence of que in the relative clause indicates that it is the object of the clause that is relativized:

4.6 Le lion que le cheval pousse fait tomber la vache.
4.7 Le lion que pousse le cheval fait tomber la vache.
'The lion that the horse pushes knocks down the cow.'

Yet children interpret (4.7) as a subject relative, suggesting that they are ignoring morphological cues and relying on an SVO strategy for assigning functional relationships by means of other heuristics, namely a reliance on the standard word order of French. As stated by Sheldon, "the evidence from French indicates that Slobin's Preferred Word Order Hypothesis is a possible candidate for a language universal" (1977, p. 61).

4.3 Independent Motivation for the S>O Hypothesis

As mentioned earlier, within the past decade there has been a shift in emphasis from a purely syntactically oriented approach to language processing to a more functionally based one. This new emphasis on the communicative function of the sentence components has

University of Alberta

provided the impetus for research which has shed light on the issue of the function of the traditional sentence subject (e.g., Ertel, 1977; Osgood & Bock, 1977).

Osgood (1977) states that

> . . . simple cognitions are tripartite in structure, . . . consisting of the meaning of one perceived entity, later of a subject NP, the meaning of the perceived action or stative relation, later of a verb phrase, and the meaning of another perceived entity, later of an object noun phrase (p. 92).

He notes that it is intuitively obvious that for Action relations, the natural order will be ACTOR-ACTION-RECIPIENT. He futher points out that this is not a consequence of the fact that English is an SVO language. According to Osgood (1977, p. 131), if we want to argue that the underlying order in cognizing for speakers of language types SVO, SOV, and VSO all have the basic Subject-Verb-Object structure, then two types of related evidence must be brought to bear - namely, the relative frequencies of these basic types in languages of the world, and secondly, the consistent use of SVO word order in language development.

Greenberg (1963) presents data on thirty languages and reports that the dominant surface structures of languages are almost universally VSO, SVO (most frequent), or SOV - thus practically never of a type whose dominant structure has O prior to S (in Osgood & Bock, 1977, p. 94).

Radulovic (1975) reports that young children learning Serbo-Croatian, which is a highly inflected language with extreme word order variation in adult performance, rigidly adhere to Actor-Action-Recipient sequences. The significance

University of Alberta

of her study lies in the fact that it compares English and Serbo-Croatian. Although both are SVO languages, Serbo-Croatian is highly inflected and is extremely variable in adult speech. The variability is controlled by what have been referred to as "saliency" principles. Radulovic concludes that

> contrary to the adult model, which is relatively unconstrained in its word order, children's spontaneous utterances tend to follow a fairly inflexible word-order pattern of subject-verb-object, and that an ordered language such as English versus a heavily inflectional language such as Serbo-Croatian exhibit identical strategies with respect to the development of the word order patterns. (in Osgood & Bock, 1977, p. 133)

Furthermore, as the inflectional system develops, it first gets established in the SVO order, and only later does flexibility in word order begin to appear. Although the verb may shift about somewhat, thereby explaining the presence of VSO and SOV, as well as SVO word orders, utterances with O before S are practically non-existent.[7] Bates (1974) argues for the operation of a salience principle to account for word order in child language. Greenfield and Smith (1974) investigated children at the one-word stage of language

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[7]Radulovic examined the adult utterances to determine whether adults reduce all their utterance to SVO structures, but found word order in adult utterances to be extremely variable (in Osgood and Bock, 1977, p. 133). This finding seriously challenges claims made by Slobin (1973), who has suggested that word order in child language preserves the order of the input adult language. Also, studies by Snow (1972) and others who have studied input to child language ("motherese") have found that adults tend to modify their own speech in accordance with the comprehension levels of their siblings presumably to facilitate comprehension and consequently acquisition.

University of Alberta

acquisition and found that the single element in a situation which the child chose was that undergoing greatest change or emphasis. At the two-word stage Bates (1974) found that Italian children expressed new high-information elements before old low-information elements, and on the basis of her observations proposed a pragmatic ordering principle in which the strategy is to place the more salient element first.

The saliency of the subject has been tested in other studies involving adult subjects. Suci and Hamacher (1972) used linguistic stimuli and found that it affected reaction times significantly, favouring the initiator. Segalowitz (1975, p. 60) found that in the nonverbal condition, the semantic relationships indicated by action roles are significant factors in the processing of visual information. He found that when both initiator and recipient are mentioned in sentences, usually the initiator is the subject of the sentence and is therefore communicated first in the the sentence. He concludes that whether coded linguistically or visually, the initiator of an action has priority for the focus of attention, and that specifying no focus of attention at all produces a focus on the initiator. Segalowitz (1975) attempts to explain why the initiator should have processing priority, suggesting that initiators occupy a more central focus position in memory. He interpreted his results as support for a cognitive hypothesis - that is, elements in the structure are

University of Alberta

conceptual primitives specifying the action and the semantic relationships between the action and the participants in it (p. 77).

Osgood admits that while these studies are difficult to interpret, "there are several ways in which a sentence construction can be 'more important' with respect to the needs of the speaker and hearer - they tend to confirm the intuition that there is something 'different' about the surface subject" (1977, p. 100).

4.4 Independent Evidence for the Verb/Object Proximity Hypothesis

As mentioned above, Lehmann (1973) has observed that languages tend to conform to certain patterns of surface word order, for example, which suggests that there is an interplay between the perceptual properties of human beings and the structural properties of grammars. Also, interruptions of certain main constituents tend to be avoided, presumably because they contribute to psychological complexity. In a typological study of surface word order Lehmann observed that in consistent VO languages sentential verb modifiers such as reflexive, negative, and interrogative markers precede the verb they modify, and that nominal modifiers such as relative clauses follow the noun they modify. In consistent OV languages, the reverse results. The principle Lehmann extracts from these observations is that an interruption separating the subject

University of Alberta

from the rest of the sentence is not as difficult to process as an interruption separating the verb from its object - that is, the relationship between these two components of a sentence (i.e., V and O) in a given language is always more cohesive, and that the S in SVO formulae is more independent than are the categories represented by V and O (1973, p. 51).[8] Moravcsik (1971) suggested that whenever two words agree as do a subject and verb, they denote a proposition and consequently go together mentally. Most rules of agreement simply reinforce such groupings and underline their coherence as perceptual Gestalts. But rules of agreement can also link words that are compelled to be separated by other factors. In such an instance, rules of agreement have an especially critical processing function, for they may provide the only way of indicating that two words refer to the same entity. Lehmann noted that in no language was he able to find only verb and object agreement, so presumably recoverability of the relationship would be difficult if the components were separated. Words that reflect closely linked propositions, then, belong together in a surface constituent, it would appear. Futher evidence in support of the notion that a VO unit forms a perceptual unit comes from languages where the V and O can often be lexicalized as a single verb form (e.g. 'take a bath' can be lexicalized as 'bathe'). If there is, in fact, an interplay

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[8] Some theorists of the 'case grammar' persuasion, in fact, are in favor of excluding subjects from the base phrase-structure rules altogether, and suggest that subject selection is a form of topicalization (see Southard, 1971).

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between the perceptual properties of human beings and the grammars they learn, as has been suggested by Bever (1970) and Lehmann (1973), this would imply that the relative clauses should be more difficult to process if the object has been fronted, thereby separating it from the verb. Indeed, one of Sheldon's (1972) and Ervin-Tripp's (1973) observations was that the subjects had difficulty finding a patient in relative clause types OO and SO, precisely those in which the object is fronted.[9] These results suggest that the V and O form a perceptual bond. Given this assumption, the following prediction can be formulated:

The V/O PROXIMITY HYPOTHESIS

Relative clauses in which the object is fronted will be more difficult to process than clauses in which there is no interruption between the verb and object.

On the basis of this claim we would expect sentence types SS and OS to be less difficult to process than types SO and OO. Although this claim resembles the Word Order Hypothesis in its predictions for English, the motivation for proposing such a strategy is different, for it essentially combines aspects of both the Word Order Hypothesis and the Interruption Hypothesis into a single principle which is an attempt at predicting how a language processor will organize

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[9]The difficulty in processing such structures could also conceivably be explained by the fact that when the object is fronted as it is in types OO and SO, the O precedes S, thereby violating Lehmann's observations regarding the S>O constraint discussed above .

University of Alberta

information present in the surface structure into propositions by establishing semantic units or links among certain surface constituents. It appears that Slobin's restriction against breaking up internal units is too vague in its present formulation and should be restated as a constraint specifically against the breaking up of tightly linked semantic units.

4.5 The Experiments

This study employs four experiments, two dealing with English-Ukrainian bilingual children, the third with native English-speaking adults, and the fourth, with adults whose first language is Ukrainian. The motivation for each experiment and the design is detailed below.

4.5.1 Experiment 1: The English Study

Palermo and Molfese (1971) suggest that a great deal of linguistic development occurs after 5 years of age; consequently, by studying children between the ages of 5 and 11 , we should be in a better position to study the changes that occur in the children's strategies as they move toward adult mastery of their native language.[10] Research has shown that the earliest and most primitive strategy children apply is a semantically-based one. The first aspect of structure they attend to is word order, which they interpret in a

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[10] According to Asher and Garcia (1969), children well into their teens may still be acquiring syntax.

University of Alberta

rigid and invariant way, as evidenced by the imposition of an NVN=SVO interpretation on passives (Slobin, 1966). It is only after about 3;6 years of age that performance on passives indicates that children are attending to other surface cues. Language development can thus be interpreted as the development of more and more strategies for interpreting a wider and wider range of relationships between forms and meanings. Adults do not have different strategies, but rather a more complete set of strategies, according to Slobin. Although Bever (1970) and Slobin (1973) have discovered a great deal about the strategies used in early language development, there is a considerable gap between the early strategies that appear to depend upon word order and the more sophisticated ones utilized by adults. Although the specifics of this evolution are vague, a different stance has been taken by Slobin (1973) and others (Ervin-Tripp, 1973), suggesting that the early operating principles are gradually replaced by more specific strategies designed to deal with the particular language being acquired. Implicit in such a notion is the prediction that strategies of language processing are first more language independent and then become more language specific; consequently, the earlier strategies should be the better candidates for language-universal processing heuristics. Ervin-Tripp (1973, p. 119) found that, indeed, in the deterioration of language skills in bilingual children, the more language-specific rules were lost first.

University of Alberta

4.5.1.1 Design

This study extends Sheldon's (1974) toy-moving experiment in English. Twelve sentences with relative clauses were constructed so that there were three examples of each of the four types of relatives listed in Table 1.1. Half of the sentences were self-embedded (with the relative clause on the subject NP), and half were right-branching (with the relative clause on the final NP). The four sentence types were controlled for three syntactic variables - the position of the relative clause, the word order in the relative clause, and the grammatical function of the relative pronoun (see Appendix A). In addition, a coordinate paraphrase of each relative clause structure type was presented to assure the experimenter that the subject understood both propositions expressed in the relative structure. For instance, the following sentences illustrate a stimulus sentence in its relative clause structure and its coordinate paraphrase:

4.8 The boy pushes the dog that bites the cat.

4.9 The boy pushes the dog and the dog bites the cat.

Each child received a randomized list of twelve stimulus relative clause structures and four coordinate structures. In addition, filler sentences were interspersed throughout the presentation in order to reinforce a sense of successful completion of the task on the part of the child. Each task

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took approximately thirty minutes to complete.

4.5.1.2 Subjects

The twenty-seven subjects were English-speaking students attending Rio Terrace Elementary School in Edmonton, Alberta. They ranged in age from 6 to 11 years of age and were classified into three groups: Group I (6;0-7;6), Group II (7;7-9;4), Group III (9,5-11). Each group contained four males and three females or vice versa.

4.5.1.3 Materials

The materials used in the experiment were toy animals which the subjects could move in accordance with the stimulus sentences. The stimulus sentences are listed in Appendix A.

4.5.2 Experiment 2: The Ukrainian Study

4.5.2.1 Motivation

Developmental psycholinguistics has made great strides in bringing new and powerful analytical tools to bear on the intriguing question of language acquisition. The majority of this work has dealt with the acquisition of English, and unfortunately, little acquisitional data from other languages is yet available. Although Ukrainian is an Indo-European language, it is sufficiently different from English, most clearly in its highly inflectional grammatical structure and in its relatively flexible word order, to

University of Alberta

serve as a useful contrast case to sharpen notions of universal aspects of language acquistion. To add to the growing body of evidence on relative clause comprehension, the methods of Experiment 1, which deals with English, an invariant word order language, are applied to Ukrainian, which has relatively variable word order. Armed with evidence from both languages, we can further test the hypotheses mentioned above. The Ukrainian sentence types were modeled on the English ones and are presented in Table 4.5. Within each of the four types listed in Table 4.5, two different relative pronouns are possible - the neutral shcho, which is equivalent to the English that, and kotryj or jakyj, which are dialectal variants and translate as either 'which' or 'who', and consequently have either an animate or inanimate antecedent. Furthermore, the relative clauses were presented in two word orders - SVO and SOV for relativized subjects, and OSV and OVS for relativized objects. Sentence (1) in Table 4.5, for instance, has the following variants:

1a. Pesyk, kotryj pkhaje mavpu, kusaje kurchatko. (SVO)

1b. Pesyk, kotryj mavpu pkhaje, kusaje kurchatko. (SOV)

1c. Pesyk, shcho (vin) pkhaje mavpu, kusaje kurchatko. (SVO)

1d. Pesyk, shcho (vin) mavpu pkhaje, kusaje kurchatko. (SOV)

'The dog that (he) is pushing the monkey is biting the chick'

University of Alberta

Table 4.5 Four Types of Relative Clause Structures Tested in Ukrainian

Subject relatives:

1. Subject NP relativized (SS):

Pesyk, shcho (vin) pkhaje mavpu, kusaje kurchatko.

'The dog that (he) is pushing the monkey, is biting the chick'

2. Object NP relativized (SO):

Pesyk, shcho (joho) kusaje mavpa, pkhaje kurchatko.

'The dog that the monkey is biting (him), is pushing the chick'

Object relatives:

3. Subject NP relativized (OS):

Pesyk kusaje mavpu, shcho (vona) pkhaje mukhu.

'The dog is biting the monkey that (she) is pushing the fly'

4. Object NP relativized (OO):

Pesyk pkhaje mavpu, shcho (jiji) mukha kusaje.

'The dog is pushing the monkey that the fly is biting (her)'

Similarly, sentence (4) of Table 4.5 has the following variants:

4a. Pesyk pkhaje mavpu, kotru mukha kusaje. (OSV)

4b. Pesyk pkhaje mavpu, kotru kusaje mukha. (OVS)

4c. Pesyk pkhaje mavpu, shcho (jiji) mukha kusaje. (OSV)

4d. Pesyk pkhaje mavpu, shcho (jiji) kusaje mukha. (OVS)

'The dog is pushing the monkey that (her) the fly is biting'

University of Alberta

The Ukrainian sentence types differ from the English in several important respects. All NPs are marked for gender, number, and case; therefore, there should be no confusion with respect to grammatical functions (i.e., subject-object) or semantic relations (agent-patient) of the NPs. The relative pronoun kotryj varies in form according to its function within the relative clause and agrees in gender and number with its antecedent. Because the relative pronoun contains all the information necessary to assign a function to the relativized NP in an unambiguous manner, the child processor presumably has access to all relevant information for determining the function of the pronoun and also in dermining its antecedent. For example:

4.9 Pesyk(Nom. Masc. Sing.), kotryj(Nom. Masc. Sing.) kusaje mavpu(Acc. Fem. Sing.), pkhaje kachku(Acc. Fem. Sing.) (SS)

'The dog that is biting the monkey is pushing the duck'

The relative pronoun in the above sentence can only refer to pesyk.[11] In this manner, morphological cues provide all the information necessary for the correct interpretation of the appropriate relationships - that is, nominative denotes the subject or agent of an action, and the accusative case the object or patient.[12] If error analysis reveals that the mistakes made in Ukrainian are identical to those made in English, or that sentence type (1a) (=SVO word order) and (4a) (=OSV word order) are more easily comprehended than are (1b) and (4b) respectively, then we have some basis for arguing that word order overrides morphological cues at certain stages of language comprehension, and that children are relying on an SVO word order strategy in parsing the

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[11] Sheldon has argued that when such an isomorphic relation exists between form and function, the parallel constraint is not a necessary strategy in the comprehension of such utterances. Yet, if it is a language-independent processing heuristic, as has been proposed, it should presumably affect all language processing.

[12] The vast majority of subjects in a pilot study found shcho easier to comprehend, and in fact, most were confused when presented with a stimulus sentence containing kotryj or jakyj; consequently only shcho was used throughout the main study dealing with children. The "copied" pronoun was, however, included in the stimulus sentences of the adult study.

University of Alberta

surface structure of utterances as late as eleven years of age.

4.5.2.2 Subjects

The twenty-one subjects were children attending Ukrainian classes at St. George's Greek Orthodox Church. They all spoke Ukrainian at home, and for many, Ukrainian was their first language. The subjects ranged in age between 6 and 11 years of age and were classified into three groups: Group I (6;0-7;6), Group II (7;7-9;4), and Group III (9;5-11). Each group consisted of four girls and three boys or vice versa. The grouping of subjects was based on teacher evaluations.

University of Alberta

4.5.2.3 Materials

The materials used in the experiment were toys which the subjects could move in accordance with the stimulus sentences. The stimulus sentences are found in Appendix B.

4.5.3 Experiment 3: English Normative Data

An assumption made implicitly in all the studies reviewed in Chapter Two is that for adult speakers of English, the four distinct structures containing relative clauses are all equally natural and easily comprehended. In order to provide normative adult data associated with this assumption, a third experiment was undertaken.

4.5.3.1 Procedure

In order to obtain normative data on the four sentence types used in Experiment 1, seventeen native speakers of English were presented with written versions of 40 stimulus sentences made up of ten replications of the four sentence types. The order of presentation was randomized, and subjects were instructed to rate each sentence on a 9-point scale according to ease of comprehension, with "1" being the easiest to comprehend and "9" the hardest. Subjects were requested to register their first impressions and not to analyze the sentences in great detail. The stimulus sentences are listed in Appendix C. The data for analysis consisted of naturalness judgements of the four sentence types, with ten replications.

4.5.4 Experiment 4: Ukrainian Normative Data

4.5.4.1 Procedure

In order to obtain normative data on the eight sentence types used in Experiment 2, seventeen native speakers of Ukrainian were presented with written versions of 56 stimulus sentences made up of seven replications of each of the eight variants of syntactic type and word order - namely, SS(SVO and SOV), OS(SVO and SOV), OO(OSV and OVS), and SO(OSV and OVS). The order of presentation was randomized, and subjects were instructed to rate each sentence on a 9-point scale according to ease of comprehension, with "1" being the easiest to comprehend and

University of Alberta

"9" the hardest. Subjects were requested to register their first impressions and not to analyze the sentences in great detail. The stimulus sentences are listed in Appendix D. The data consisted of naturalness judgements of the eight sentence types with seven replications.

4.6 Summary

This chapter has presented a detailed outline of the experiments along with the motivation for each hypothesis tested. The results of the experiments, including a description of the response categories for Experiments 1 and 2 are reported in Chapter Five. An interpretation of the results and their implications for further research are presented in Chapter Six.

University of Alberta

CHAPTER FIVE

RESULTS AND DISCUSSION

5.1 THE EXPERIMENTS

5.1.1 Experiment 1: English Study

The data were scored as either correct (1) or incorrect (0) and assigned to appropriate categories so that a percentage correct figure could be obtained for each sentence type by subject.

The ANOVA model used here was a three-way, fixed effects, factorial design with Ss serving as replications nested within age. The three treatment factors were position of embedding (two levels), age (three levels), and function of the relative pronoun (two levels). The data consisted of these measures for each of the four sentence types and each of the 27 subjects. The computer program employed was BMD:08V (Dixon, 1970). Table 5.1 summarizes the results of the subjects' performance on the four types of relative clause structures under the various conditions of embedding (E), parallel vs. non-parallel function (F), and age (A). Of these, only the main effects of embedding and age were significant ($p < 0.01$).

Differences between means were evaluated with the Newman-Keuls test for ordered means (e.g. , Winer, 1971). In this procedure the critical value that a difference must

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Table 5.1

Analysis of Variance, Experiment 1.

Source	df	Sum of Squares	Mean Square	F
Mean	1	498440.0	498440.0	525.96
E	1	19872.4	19872.4	20.97**
F	1	163.787	163.787	0.71
A	2	21366.5	10683.2	11.27**
EF	1	670.021	670.021	0.17
EA	2	1876.36	983.180	0.99
FA	2	4614.68	2307.34	0.34
EFA	2	642.984	321.492	2.43
R(EFA)	96	90977.4	947.682	

exceed in order to be considered significant varies according to how many steps apart the relevant means are when placed on a scale ranging from smallest to largest. This is done because if several means are computed by sampling from the same population, the largest and smallest sample means may appear to differ simply because they lie at extreme ends of the same distribution. With the Newman-Keuls procedure, the critical value of Wr is largest for the most widely spread means, and smaller for those which lie close together.

The average score on all four sentence types considered together improved significantly with age (F,(2,96)=11.27,

Table 5.2

Newman-Keuls Test Experiment 1

	A_1	A_2	A_3
A_1	--	13.944	34.3059**
A_2		--	20.36119**

W_2 = 14.365 (p = .05) W_3 = 18.98 (p = .05)
= 17.239 (p = .01) = 21.55 (p = .01)

$p < 0.01$). The results of the Newman-Keuls indicate that only the third age group was significantly different from the other two ($p < 0.01$). A summary of the results is given in Table 5.2.

The main effect of embedding (E) was highly significant (F,(1,96)=20.97, $p < 0.01$). The Newman-Keuls comparison of means for the effect of (E) is presented in Table 5.3. The results indicate that performance on both types OS and OO was significantly better than types SS and SO ($p < 0.01$). That is, right-branching sentences were found to be significantly easier to comprehend than center-embedded ones. The results of this test, then, support Slobin's Interruption Hypothesis, lending support to his claim that sentences containing interruptions are more difficult for the language processor than those which contain no

Table 5.3

Newman-Keuls Test, Experiment 1

	E_2	E_1
E_2	--	27.1296**

W_2 = 11.72 (p = .05)
= 15.50 (p = .01)

E_1 and E_2 refer to right-branching and center-embedded sentences respectively.
E_1 includes sentence types OS and OO;
E_2 includes types SS and SO.

interruptions.

The function of the relative pronoun within the relative clause is not significant and therefore the results do not support Sheldon's Parallel Function Hypothesis, which predicts that sentences in which the relative pronoun and its antecedent share a similar grammatical function are significantly easier to process than those in which they play different grammatical roles.

Finally, it was hypothesized that word order within the relative clause would be a factor affecting the comprehension of the relative clause structures. That is, it was predicted by Sheldon (1972, p .2), after Slobin's principle of fixed word order, that sentence types OS and SS would be easier to process than types OO and SO because the former maintain the standard English SVO word order within

the relative clause as opposed to the latter, which permute this standard order. The overall effect of word order, however, was not significant when the results of all three age groups were pooled.

5.1.1.1 Summary of the Responses: Experiment 1

The notation adopted to tabulate the responses of the subjects participating in the toy-moving task is identical to that employed by Sheldon (1972), in which the noun phrases are numbered consecutively and then the children's responses to the stimulus sentences are noted in terms of these numbers. Consider the following sentence:

University of Alberta

The dog that the horse kicked bit the sheep. (SO)
1 2 3

A correct response should indicate that the horse kicked the dog and the dog bit the sheep; consequently, the correct response to the above sentence would be coded as 21,13. The first pair of numbers represents the actor-patient relationship of the first clause acted out, and the second pair represent the actor-patient of the second clause. Tables 5.4 to 5.8 represent a breakdown of the responses to the stimulus sentences in Experiment 1, followed by an interpretation of the results and strategies which appear to

have been utilized in the completion of the task.

To summarize the results of Experiment 1: Only the factors E (position of embedding) and A (age) were significant. In particular, right-branching was easier than center-embedding, and as age increased, overall performance increased.

5.1.1.2 Error Analysis: Experiment 1

Multiple-clause sentences are a challenge to children's parsing strategies and invite misinterpretation. The child must determine the boundaries for each simplex sentence and determine a referent for each missing element in a sentence. A great number of children's errors in interpreting complex sentences are systematic response patterns and provide information concerning the types of strategies a child employs in language comprehension. A safe assumption to make is that children will rely on the parsing strategies they already possess in attempting to process difficult or unfamiliar structures.

Table 5.5 summarizes the response categories for the SS relative clause structures. The majority of the errors (42%) were Adjacency errors in which NVN sequences were interpreted as actor-action-patient. Consequently, in a sentence such as 'The dog that pushed the monkey touched the horse, the monkey was interpreted to be the agent of the main clause. The predominant strategy on SS relative

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Table 5.4

Number of correct responses by age group: English data

(Total possible correct answers for each type at each age=27)

Age	1 OS	2 OO	3 SS	4 SO
I (6-7;6) N=9	18 (66%)	20 (74%)	12 (44%)	6 (22%)
II (7;7-9;4) N=9	25 (92%)	18 (67%)	13 (48%)	15 (56%)
III (9;5-11) N=9	26 (96%)	25 (93%)	20 (74%)	22 (81%)
TOTAL N=27	69 (85%)	63 (78%)	45 (56%)	43 (53%)

TOTAL POSSIBLE CORRECT FOR EACH SENTENCE TYPE=81

Table 5.5

Distribution of Responses to SS Relative Clauses

The dog that pushed the monkey touched the horse.
1 2 3

Age Group	Response Categories			
	Correct Response 12,13	Adjacency 12,23	Other 32,13	Other=00 12,32
I	12	13	1	1
II	13	14	0	0
III	20	7	0	0
Total	45 (56%)	34 (42%)	1 (1%)	1 (1%)

Table 5.6

Distribution of Responses to OS Relative Clauses

The dog touched the monkey that pushed the horse.

1 2 3

Age Group	Response Categories	
	Correct Response 12,23	Conjoined Analysis 12,13
I	18	9
II	25	2
III	26	1
Total	69 (85%)	12 (15%)

Table 5.7

Distribution of Responses to OO Relative Clauses

The dog touched the mouse that the monkey pushed.
1 2 3

Age Group	Response Categories		
	Correct Response 12,32	SO Errors 12,31	Adjacency Errors=12,23
I	20	5	2
II	18	5	4
III	25	1	1
Total	63 (78%)	11 (14%)	7 (9%)

Table 5.8

Distribution of Responses to SO Relative Clauses

The dog that the mouse touched pushed the monkey.
1 2 3

Age Group	Response Categories			
	Correct Response 21,13	Adjacency Error 12,23	Conjoined Analysis 12,13	'Other' 21,23
I	6	8	5	7
II	15	6	2	4
III	22	1	3	1
Total	43 (53%)	15 (19%)	10 (13%)	12 (15%)

structures was an Adjacency strategy. Other errors account for only 2% of the total responses.

Table 5.6 summarizes the response categories on the OS relative clause structures. Error analysis indicate that all errors made pointed to a Conjoined Clause Analysis. That is, the first NP was treated as the subject of both clauses. A sentence such as "The dog pushed the cat that jumped over the mouse" was apparently interpreted as The dog pushed the cat "and" the dog jumped over the mouse. This suggests that the subject was attending to the linear order of elements, disregarding the relative pronoun and interpreting the first NP of the sentence as the extraposed subject of the relative clause. The evidence, then, supports the claim that children utilized a Conjoined Clause Analysis to interpret right-branching structures and that the conjoined clause analysis is a very productive heuristic for the child.

Table 5.7 summarizes the response categories of the OO relative clause structure types. The predominant response type in parsing the OO relative structures was what we have labeled an SO error. That is, given the S V O [RP S V] structure of the OO sentence types, the errors made suggest that the subjects interpret the relative clause as modifying the matrix NP, accounting for the SO interpretation -- namely, S [RP S V]V O. The SO interpretation, then, accounts for 14% of the errors made on OO relatives; Adjacency errors

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account for 9% of the responses. This confounding of the OO and SO types will be discussed in greater detail in Chapter Six.

Table 5.8 summarizes the response categories on the SO relative clause structures. The fact that the SO relative clause types are more difficult for children to comprehend is reflected in the number of response categories. Three different strategies account for all the errors on this particular sentence type - namely, Adjacency errors, Conjoined Clause Analysis, and a category we have labeled as 'Other' errors. This last category, however, which accounts for 15% of the total errors, is essentially a Conjoined Clause Analysis in which the second NP (i.e., the true subject) is treated as the subject of both clauses, hence the 21,23 coding. What has been considered a Conjoined Clause Analysis error is a 12,13 response, in which the first NP of a sentence is interpreted as the subject of both clauses. In SO structures, this would be the object of the relative clause. Thus, given a sentence such as the following:

The monkey that the dog pushed kicked the duck.
1 2 3

a correct response would be 21,13; a Conjoined Clause

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Analysis would yield a 12,13 interpretation, in which "The monkey pushed the dog and the monkey kicked the duck" and the response category labeled 'Other' would be one in which the response pattern would be 21,23, as in "The dog pushed the monkey and the dog kicked the duck." Thus, one of the problems the subjects had was in determining which NP of the first clause is the subject - hence the 12,13 and 21,23 responses. Both errors are interpreted as conjoined clauses, in the sense that one NP is selected to function as subject of both propositions, the only difference being which NP is chosen as subject.

It is important to note that a very small number of response categories, namely three, account for nearly all the responses. Furthermore, these predominant strategies -- the Adjacency and Conjoined analyses -- are based on the linear order of elements in a sentence. The third strategy labeled as the 'Other' response category, is interesting from a developmental psycholinguistic point of view. There is a considerable difference in the ease of comprehension on the OO and SO types within the first age group. Performance on type OO drops in the second age group, with a simultaneous increase in performance on type SO, which suggests that at that age, the subjects are confounding the two types. Eventually, they sort out the antecedents and performance improves on both types. A detailed analysis of this issue is presented in Chapter Six.

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5.1.2 Experiment 2: Ukrainian Study

The data were scored as either correct (1) or incorrect (0) and assigned to appropriate categories so that a percentage correct figure could be obtained for each sentence type by subject.

The ANOVA model used here was a two-way, fixed effects, factorial design, with subjects (Ss) serving as replications. The two treatment factors were age (three levels) and factor C (eight levels), which accounted for all possible combinations of word order and sentence type. The data consisted of these measures for each of the eight conditions and each of the 21 subjects. The computer program employed was BMD:08V (Dixon, 1970). Table 5.9 summarizes the results of the subjects' performance on the four types of relative clauses structures under the various conditions of (C) and age (A). Both factors were significant ($p < 0.01$).

The main effect of C was highly significant (F, $(2,18)=14.55$, $p < 0.01$). Differences between means were evaluated using planned comparisons. The results indicate that the main factor separating the eight conditions into two equal groups was the position of the subject with respect to the object within the relative clause. When the subject preceded the object, performance was significantly better than when the object preceded the subject (F, $(7,126)=85.12$, $p < 0.001$). Thus, the S>O version of the word order hypothesis (Word Order b) is confirmed, since in

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relative clauses the word orders SOV, SVO are significantly easier than OSV, OVS. In those instances where the object preceded the subject (e.g., OSV, OVS), there was a preference for keeping the verb in clause final position ($F,(7,126)=14.48$, $p < 0.01$); otherwise, the first NP, namely the object, was interpreted as the subject. There were no significant differences between SVO and SOV word orders. The significant preference of OSV over OVS, coupled with the non-significant difference between SVO and SOV serves to refute the Verb-Object Proximity version of the word order hypothesis (Word Order c). The "global" SVO version (Word Order a) is also directly refuted.

The average score on all sentence types considered together improved significantly with age ($F,(2,18)=15.18$, $p < 0.01$). The results of the Newman-Keuls procedure indicate that the third age group differed significantly from the other two groups ($p < 0.01$). A summary of the results is given in Table 5.10.

The results of the Ukrainian data indicate that interruption is not a factor separating performance on the sentence types. The most salient feature the children appeared to be attending to was the relative position of the subject and object within the relative clauses. They had little difficulty comprehending those structures in which S preceded O. When the reverse was true, there was a preference for having the verb in clause-final position - that is, [OSV] was preferred to [OVS], and in structures

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Table 5.9

Analysis of Variance: Experiment 2

Source	df	Sum of Squares	Mean Square	F
Mean	1	537202.	537202.	232.90
C	7	92321.4	13188.8	14.55**
A	2	70029.8	35014.9	15.18**
S(A)	18	41517.8	2306.54	
CA	14	19731.9	1409.42	1.56
CS(A)	126	114193.	906.292	

Table 5.10

Newman-Keuls Test: Experiment 2

	A_1	A_2	A_3
A_1	--	25.893	50.00**
A_2		--	24.11**

W_2 = 17.969 (p=.05)
= 23.746 (p=.01)

W_3 = 21.564 (p=.05)
= 26.955 (p=.01)

such as [OVS], the first NP, namely the object of the relative clause, was interpreted as the subject. The results of this experiment, then, support a functional analysis in which the agent-patient ordering of semantic information is maintained.

5.1.2.1 Summary of the Responses: Experiment 2

The notation adopted to tabulate the responses of the subjects participating in Experiment 2 is identical to that outlined for Experiment 1. Tables 5.11 to 5.15 represent the distribution of the responses in Experiment 2. Each is followed by an interpretation of the results and strategies which appear to have been utilized in the performance of the task.

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5.1.2.2 Error Analysis: Experiment 2

Table 5.12 summarizes the results of the responses on the OS relative clause structures. The predominant errors on these types can be accounted for by the Conjoined Clause Analysis strategy.

Table 5.13 summarizes the results of the response categories on the SS relative structures. The only errors made on these particular types (in both SVO and SOV word orders) were Adjacency errors (27% of total responses).

Table 5.11

Number of correct responses by age group: Ukrainian data

(Total possible correct answers for each sentence type at each age=28)

Age	OS		SS		OO		SO	
	(SVO)	(SOV)	(SVO)	(SOV)	(OSV)	(OVS)	(OSV)	(OVS)
I (6-7;6) N=7	10	8	6	7	2	1	1	0
	18 (64%)		13 (46%)		3 (11%)		1 (4%)	
II (7;7-9;4) N=7	12	14	12	9	8	0	7	2
	26 (93%)		21 (75%)		8 (29%)		9 (32%)	
III (9;5-11) N=7	13	12	14	14	11	9	11	7
	25 (89%)		28 (100%)		20 (71%)		18 (64%)	
TOTAL N=21	69 (82%)		62 (74%)		31 (37%)		28 (33%)	

TOTAL POSSIBLE CORRECT FOR EACH SENTENCE TYPE=84

Table 5.12

Distribution of Responses to OS Relative Clauses

Pesyk pkhaje mavpu, shcho kusaje konyka. (=SVO Word Order)
1 2 3

Age Group	Response Categories	
	Correct Response 12,23	Conjoined Clause Analysis 12,13
I	10	4
II	12	2
III	13	1
Total	35 (83%)	7 (17%)

Pesyk pkhaje mavpu, shcho konyka kusaje. (=SOV Word Order)
1 2 3

Age Group	Response Categories			
	Correct Response 12,23	Conjoined Analysis 12,13	Other 12,32	Other 23,12
I	8	2	2	2
II	14	0	0	0
III	12	2	0	0
Total	34 (80%)	4 (10%)	2 (5%)	2 (5%)

Table 5.13

Distribution of Responses to SS Relative Clauses

Pesyk, shcho pkhaje mavpu, kusaje konyka. (=SVO in Relative Clause)
1 2 3

Age Group	Response Categories	
	Correct Response 12,13	Adjacency Errors 12,23
I	6	8
II	12	2
III	14	0
Total	32 (76%)	10 (24%)

Pesyk, shcho mavpu pkhaje, kusaje konyka. (=SOV in Relative Clause)
1 2 3

Age Group	Response Categories	
	Correct Response 12,13	Adjacency Errors 12,23
I	7	7
II	9	5
III	14	0
Total	30 (71%)	12 (29%)

Table 5.14

Distribution of Responses to SO Relative Clauses

Pesyk, shcho mavpa pkhaje, kusaje konyka. (=OSV in Relative Clause)
1 2 3

Age Group	Response Categories		
	Correct Response 21,13	Conjoined Analysis 12,13	Adjacency Errors 12,23
I	1	7	6
II	7	4	3
III	11	3	0
Total	19 (45%)	14 (33%)	9 (22%)

Pesyk, shcho pkhaje mavpa, kusaje konyka. (=OVS in Relative Clause)
1 2 3

Age Group	Response Categories		
	Correct Response 21,13	Conjoined Analysis 12,13	Adjacency Error 12,23
I	0	7	7
II	2	9	3
III	7	6	1
Total	9 (22%)	22 (52%)	11 (26%)

Table 5.15

Distribution of Responses to OO Relative Clauses

Pesyk pkhaje mavpu, shcho konyk kuşaje. (=OSV in Relative Clause)
1 2 3

Age Group	Response Categories			
	Correct Response 12,32	Adjacency Error 12,23	Conjoined Analysis 12,13	SO Error 12,31
I	2	3	3	6
II	8	4	1	1
IIII	11	1	1	1
Total	21 (50%)	8 (19%)	5 (12%)	8 (19%)

Pesyk pkhaje mavpu, shcho kusaje konyk. (=OVS in Relative Clause)
1 2 3

Age Group	Response Categories			
	Correct Response 12,32	Adjacency Error 12,23	Conjoined Analysis 12,13	SO Error 12,31
I	1	5	6	2
II	0	8	4	2
III	9	3	1	1
Total	10 (24%)	16 (38%)	11 (26%)	5 (12%)

Table 5.14 summarizes the responses on both types of SO relative clause structures. All of the errors were either Adjacency errors or Conjoined Analysis errors, supporting a linear word order parsing strategy for Ukrainian subjects.

Table 5.15 summarizes the results of the response categories on both types of OO relative clause structures. All errors on this sentence type were either Adjacency errors, Conjoined Clause analysis errors, or SO errors as described with respect to the English data. Despite the morphological cues available in Ukrainian, the linear word order still appears to be the predominant factor affecting parsing strategies. A more detailed discussion of the implications of these findings is presented in Chapter Six.

To summarize the results of Experiment 2: only the relative order of subject and object was significant. In particular, an S-O order was easier than O before S. In an O-S sequence, the subjects tended to interpret the first NP, namely the patient, as the agent. Also, the factor age was significant -- as age increased, overall performance increased.

5.1.3 Experiment 3: English Normative Data

The ANOVA model used to analyze the data was a two-way fixed effects factorial design. Each of the 16 subjects received ten replications of each of the four treatment conditions (syntactic types). The data consisted of five

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scores for each of the four sentence types and the 16 subjects. The computer program employed was BMD:08V (Dixon, 1970). The main effect of syntactic type was highly signfificant (F,(3,45)=13.69, $p < 0.01$). A summary of the results is presented in Table 5.16.

The results of the Newman-Keuls procedure indicate that the main factor separating the four relative structure types was word order. While types SS and OS did not differ significantly, both were significantly easier than types SO and OO ($p < 0.01$). The results indicate that sentences in which the relative clause retains the dominant SVO word order of English are easier to comprehend than those containing a perturbation of this order (i.e., OSV). The relative ease of comprehension of the four types of structures in English from easiest to hardest was: OS, SS > SO > OO. A summary of the results is presented in Table 5.17.

5.1.4 Experiment 4: Ukrainian Normative Data

The ANOVA model used to analyze the data was a two-way fixed effects factorial design. Each of the 17 subjects received seven replications of each of the eight treatment conditions (i.e., syntactic type by word order combinations). The data consisted of seven scores for each of the eight sentence types and the 17 subjects. The main effect of sentence types was highly significant (F,(7,112)=13.27, $p < 0.01$). Table 5.18 summarizes the

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Table 5.16

Analysis of Variance: Experiment 3

Source	df	Sum of Squares	Mean Square	
Mean	1	8925.16	8925.16	
S	15	357.544	23.8362	8.61**
T	3	113.719	37.9063	13.69**
ST	45	124.579	2.76843	1.89**
R(ST)	576	844.943	1.46692	

Table 5.17

Newman-Keuls Test: Experiment 3

	OS	SS	SO	OO
OS	--	0.0375	0.6125**	1.0125**
SS		--	0.5750**	0.9750**
SO			--	0.4000*

W_2 = .3762 (p=.05) = .5025 (p=.01)
W_3 = .4525 (p=.05) = .5748 (p=.01)
W_4 = .4985 (p=.05) = .6182 (p=.01)

Table 5.18

Analysis of Variance: Experiment 4

Source	df	Sum of Squares	Mean Square	F
Mean	1	16647.4	16647.4	259.43
S	16	1026.72	64.1701	32.19**
T	7	326.486	46.6409	13.27**
ST	112	393.756	3.51567	1.76
R(ST)	816	1626.47	1.99322	

results of the Ss' performance on the eight types of sentences.

The main effect of T (Sentence Type) was highly significant ($p < 0.01$). Differences between means were evaluated using planned comparisons. The results indicate that the main factor separating the eight sentence types into two equal groups was the position of the subject with respect to the object within the relative clause. When the subject preceded the object, performance was considerably better than when the object preceded the subject. The results of the Ukrainian normative data indicate that interruption is not a factor separating performance. As with the English normative data, the main factor separating the sentence types was the S>O version of the word order hypothesis. While types SS and OS did not differ

significantly, both were significantly easier than types SO and OO ($F,(7,112)=78.02$, $p < 0.001$). The difference in SVO and SOV word order within the relative clause in types SS and OS was found to be non-significant. The VO Proximity Hypothesis was not supported by the results. The relative ease of comprehension of the syntactic types represented in Ukrainian from easiest to hardest was: OS, SS > SO > OO.

5.2 Summary

It was found that word order is the most salient factor separating syntactic types in both English and Ukrainian relative clause structures. This was supported by the results of the experiment conducted with Ukrainian children, and with both English and Ukrainian adults. The results of the experiment with English-speaking children, however, indicated that the position of embedding was significant in determining the relative ease of comprehension, with performance on right-branching structures significantly better than on center-embedded structures. The analysis of the errors in both English and Ukrainian data indicate that the majority of errors can be accounted for by three parsing strategies - namely, the Adjacency Analysis, the Conjoined Clause Analysis, and the SO Analysis. An interpretation of these results is presented in Chapter Six, along with the implications for further research.

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CHAPTER SIX

SUMMARY

6.1 Introduction

The results of the experiments described in the preceding chapter support the notion that word order plays an important role in the parsing strategies employed by children and adults alike. The evidence for such a claim comes not only from the results of the comprehension studies conducted in English, a relatively fixed word order language, but also from Ukrainian, which is a highly inflected language, with relatively flexible word order. This chapter will attempt to determine what particular aspects of surface structure assist the language processor in parsing of sentences and the resulting implications for developmental psycholinguistics.

6.2 The Role of Surface Cues in Comprehension

C. Smith (1970) has managed to put the issue of derivational versus surface constraints on language processing into a more reasonable perspective, suggesting that the surface structures of utterances are worthy of more consideration than they have received hitherto (p. 132). Harada et al. (1976, p. 201) admit that the results of their research suggests that comprehension strategies are

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essentially the interpretation of surface structures utilizing such cues as the linear order of constituents, and that the hearer has a preconceived format for the organization of the construction of a sentence. According to this view, the hearer structures the incoming form to correspond to a preconceived 'canonical form'. This view of language processing is not new, for Z. Harris (1957) has suggested that all sentences can be reduced, in structural terms, to their global simplex structures, although Harris made no psychological claims. If, as Harris suggested, all sentences, regardless of their derivational complexity, have the global structure of simplex sentences, it is reasonable to assume that in order to understand an utterance, a hearer must reconstruct its global structure, which brings us back to the issue at hand -- namely, what aspects of surface structure configurations assist the language processor in the comprehension of relative clause structures?

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6.3 The Results of the Children's Data

The fact that children tend to treat the SS and OS types as though they were structurally identical is evidenced by the fact that the majority of their errors on both types were Conjoined Clause Analysis errors, whereby the matrix subject was interpreted as the subject of both clauses. That is, the dominant error here treated both SS and OS structures as if they were of the form [S V O and V O].

The predominant response to the OO types was the SO error. That is, given the SVO[RP S V] structure of the OO types, subjects interpreted the relative clause as modifiying the matrix subject NP, yielding an SO analysis of S[RP S V]VO. Sheldon has argued that the 12,31 and 12,13 responses to the OO type relatives result from an 'extraposition' strategy:

> From their [children's] knowledge that in English <u>some</u> relative clauses modify the matrix subject, they are overgeneralizing that <u>all</u> do. (p. 77, original emphasis)

Under the 'extraposition' hypothesis, children who interpret (6.1) below as (6.2) are presumably making the assumption that the two are equivalent in meaning, and that the relative clause in (6.1) has been extraposed from a position modifying the noun "The dog":

6.1 The dog is chasing the man [that the boy sees].

6.2 The dog [that the boy sees] is chasing the man.

If children interpret OO types as extraposed SO sentences, then SO sentence types should be exceptionally easy; yet, this is in conflict with the data, which shows SO types to be very difficult. Furthermore, the evidence from production studies reported by Limber (1973) indicates that the first relative clauses produced by his three-year-old subject were of the OO type; consequently, object relatives appeared earlier in the speech of his subjects and also in the speech of Antinucci and Parisi's subjects. If the child knows that some relative clauses modify the matrix object, he does not

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necessarily overgeneralize that all relative clauses modify the matrix object, as Sheldon's logic would predict. Otherwise, we would expect the majority of errors on the SS types to be OS errors, whereby the relative clause modifying the matrix subject NP is extraposed to sentence-final position on the analogy of the already acquired OO types. We would therefore expect an analysis whereby S[RP V O]VO structures are interpreted as SVO[RP V O]. Yet, performance on SS types was exceptionally good, and the errors were of the Conjoined Clause Analysis type. Aller (1977) found that the facts for the acquisition of relative clauses in Arabic are similar. At a certain stage of development, children interpret OS and OO types as modifying the matrix subject. However, in Arabic there is no rule of 'Extraposition from noun phrase'; therefore, the extraposition analysis in the errors committed by the child in Arabic can only be construed as the overgeneralization of a principle at a given stage of linguistic development. In particular, on the basis of the object relatives, which are apparently acquired first, children place all relative clauses in sentence-final position, although they maintain the correct functional relations. I suggest that the same holds true for English children. This is supported by the fact that although children repeated the SS and SO sentence types incorrectly, placing the relative clauses in sentence-final position, their toy-moving response suggested that they were comprehending the subject relatives as object relatives

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correctly. It would therefore appear that at this particular stage in their development (Age Group II), the children are invoking the non-interruption principle in their comprehension, but are able to imitate "correctly." That is, they behave as if the relative clause must be in final position , thereby modifying the object NP, even though they hear and repeat it in subject position.

Another common error on the OO and SO types was the NVN Adjacency Analysis whereby the linear order of NP V NP was interpreted as subject-verb-object, resulting in an OS error. An example of such an interpretation would be a sentence such as "The man saw the boy that the dog chased" interpreted as "The man saw the boy and the boy chased the dog." This strategy was particularly common in the responses of the younger children.

In both English and Ukrainian studies with children, performance on OO types was better than on SO types in the first age group. However, performance on the OO types showed very little improvement (and in fact dropped in the English study) in the second age group; performance on the SO types, however, showed a sudden improvement for the same subjects. This suggests that subjects in the second group are going through a stage in which they are sorting out the grammatical relations of the OO and SO types, and in the process are confounding the structures of SO, namely, S[RP S V]VO, with that of OO, namely, SVO[RP S V].

As mentioned in the previous chapter, the majority of

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errors in all sentence types can be accounted for by three main interpretations -- the Conjoined Clause Analysis, the Adjacency Analysis, and the SO Analysis. The most common errors committed across all sentence types were the Conjoined Clause Analysis and the Adjacency Analysis. Consequently, these strategies must be discussed in greater detail.

6.3.1 The Conjoined Clause Analysis

A Conjoined Clause Analysis refers to a strategy which may be stated as follows: When two clauses are sequential (e.g., one does not interrupt the other), and when the second conjunct has a missing subject, then the subject of the second clause is reconstructed as being coreferential with that of the main clause, just as if the two clauses were conjoined (e.g., as SVO and VO). If we apply the Conjoined Clause Analysis to all sentence types, the following interpretations result. For SS types, the correct semantic interpretation results, since the SS type has the structure S[RP V O]VO, and the subject of both verbs is the main clause subject. For the other types, however, this analysis yields erroneous interpretations. The only errors found on OS types were SS interpretations, presumably because the linear order of elements corresponds to a conjoined interpretation (e.g., SVO[RP V O]). The OO and SO types do not have the linear order of conjoined sentences, and the fact that the children made 12,13 and 21,23 errors

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on these types suggests that they were attempting to apply the Conjoined Clause Analysis to OO and SO types. One of the problems that the children had with the SO type was in determining which NP of the first clause served as subject. The younger subjects chose the first NP and treated it as a juxtaposed subject, resulting in the 12,13 interpretation. The older children tended to select the second NP as the subject, and considered it to be the subject of both clauses, resulting in the 21,23 responses. In either case, the responses indicate that the relative pronoun was interpreted as coreferential with the NP selected as the subject of the first clause. By grouping her subjects' responses on all four relative clause types according to the frequency of a conjoined analysis for each type, Tavakolian (1977) developed a hierarchy of application of this particular strategy, namely the hierarchy of SS > OS > SO > OO.[13] She concluded that there was no strong impetus for eliminating the SO relatives from the conjoined analysis.

In OO types, the NP preceding the second verb satisfies two surface constraints for subject status: it is clause-initial and pre-verbal, providing structural cues to permit it to be at least a candidate for the subject. The relative clause structures provide convincing evidence for the existence and productivity of the Conjoined Clause Analysis, since this type of error is the only response used

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[13]This hierarchy corresponds to the relative order of ease of comprehension of relative structures found in the normative adult data analyzed in this study.

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across all categories and it also accounts for the greatest percentage of errors. It appears that children find conjunction easy, and that relative clauses whose linear order of elements differs from the order of elements in conjoined clauses will be more difficult for children to assign an interpretation than to relatives whose word order conforms to the order of conjoined clauses. There was a greater variety of responses to OO and SO relatives, which do not conform to the order in conjoined clauses, than there was to SS and OS types, which do.

In summary, then, the strength of the Conjoined Clause Analysis is reflected in the great preponderance of Conjoined Clause errors found in both English and Ukrainian. The basis for this appears to be the fact that conjoined structures, which avoid interruption, are easier and earlier to appear than center-embedded structures. In fact, Slobin's Interruption Hypothesis appears to be at the heart of the Conjoined Clause Analysis, and consequently the error data from both English and Ukrainian give considerable empirical support to the hypothesis.

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6.3.2 The Adjacency Analysis

The other strategy used extensively by the subjects, particularly by the younger ones, was the Adjacency strategy, whereby an NP V NP sequence was interpeted as subject-verb-object, or alternatively, agent-action-patient. When applied to the OS types, this strategy provides a

correct interpretation, and consequently it is difficult to assess what percentage of the 'correct' responses were, in fact, correct, and how many were OS errors. As mentioned earlier, the younger children seemed to rely on this strategy more so than did the older ones; only one OS error was found for each of the OO and SO types within the third age group. This strategy was used most frequently in parsing sentence types OO and SO.

Both the OO and SO types contain a relative clause of the form [RP S V], where the first NP (i.e., the relative pronoun) was interpreted as the true subject of the clause; consequently, the second NP (i.e., the subject of the clause) was interpreted as the object, suggesting that the inverted word order, and possibly the two contiguous NPs, confuse the younger children who subsequently rely on an SVO strategy. These children, in both English and Ukrainian, seem to interpret the first NP in the relative clause as the subject; then, by default, interpret the second NP (the correct subject) as object. This strategy is even more plausible when it is remembered that the object NP in an SVO structure is contiguous to the verb, although following it, while the subject is the first NP in the clause.

In summary, both the very young English and Ukrainian children exhibit errors which suggest that the word order hypothesis in its strongest form, namely "The first NP in a clause is subject" is operative, thus providing support for Slobin's Word Order Hypothesis, and in particular for the

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S-O version.

6.4 The Results of the Adults' Data

The results of the normative data in both Ukrainian and English suggest that the ease of comprehension from easiest to hardest is: OS, SS > SO > OO, where SS and OS are not significantly different from each other, but both are significantly different from both SO and OO. If we examine the SO and OO types, we would expect that SO should be the most difficult, because it violates both the Interruption Hypothesis and the Word Order Hypotheses in both languages. These two types are exemplified in the following sentences:

6.3 The man [that the dog chased] saw the boy. (SO)
6.4 The man saw the boy [that the dog chased]. (OO)

If we reconsider the examples cited by Limber (1973, p. 172) as examples of OO type relatives, we have the following examples:

. . . ones Mommy got
. . . kind I got
. . . ball I got

It is questionable whether these fragmentary data can be considered as evidence of OO type relative clauses in the sense of (6.4) above, but rather a simple - NP NP V -

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sequence, with two contiguous NPs, as in the sentence "This is the ball I got". In the absence of that, two contiguous NPs are interpreted as object-subject-verb. This is supported by responses to such fragmentary sequences presented as stimulus material in Experiment 1, where for any sequence such as "the duck the dog pushed," the task was always acted out correctly with the dog pushing the duck. Yet, when the same structure was incorporated within a complete OO or SO relative type, such as "The duck that the dog pushed kicked the chick" or "The duck kicked the chick that the dog pushed," subjects were confused as to the antecedent of the relative pronoun.

In attempting to explain why adults should find (6.3) significantly easier than (6.4), the following interpretation suggests itself on the basis of the findings with the child data. In the absence of any other information, the only possible antecedent of the relative pronoun in (6.3) is The man. In these cases, with the relative clause formed on the first NP, the hearer may unambiguously interpret the relative pronoun. Consequently, the sequence NP [RP NP V] namely "The man that the dog chased" is easily given the structure of a complex subject NP, with no possibility for confusion as to the antecedent. In (6.4) however, the relative pronoun has two potential antecedents -- namely the matrix subject or the matrix object. Presumably the absence of that in (6.4) would facilitate the selection of the correct antecedent, namely

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the one immediately preceding the subject of the embedded clause. This has interesting implications for a study in which a comparison could be made between sentences with and without the relative pronoun that in order to determine whether its absence assists the language processor in determining the antecedent in sentences type OO and SO. In such an experiment the following sentence types could be compared:

6.5 The dog that the duck bit jumped over the cat. (SO)
6.6 The dog the duck bit jumped over the cat. (SO)

Also, consider the following:

6.7 The dog bit the duck that the cat pushed. (OO)
6.8 The dog bit the duck the cat pushed. (OO)

In (6.7) above, the presence of that separates the contiguous NPs, thereby forcing the hearer to construct an antecedent. In such a constructive process, the hearer assigns object status to the first of the two contiguous NPs in the absence of a relative pronoun as in (6.8). Thus the presence of the relative pronoun in an object relative clause should introduce antecedent ambiguity and contribute to comprehension difficulty. Evidence from experiments designed to test the comprehension skills of adult subjects on multiply embedded sentences indicate that the presence of

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that facilitates comprehension because it provides cues as to the clause boundaries (Fodor & Garrett, 1967; Hakes & Foss, 1970). At the same time, however, the presence of the relative pronoun in right-branching structures introduces the potential for ambiguity in interpretation, since in such cases there is more than one NP to the left of that, and consequently more than one possible antecedent. This suggests, then, that the early forms produced by children may, in fact, be more indicative of the manner in which children interpret structures, and consequently production and comprehension may be more alike than the results of the studies have indicated. If this analysis is correct, then, the child is not, in fact, producing OO relatives in the true sense of embedded sentences, but rather he is simply assigning functional relations to sequences which "happen" to occur in the embedded structures of adult speech.

Another consequence of having that in the surface string is that when the hearer is confronted with the relative pronoun, two different possibilities follow. Either that can be the subject of the following clause, as in OS and SS types ". . . that chased the dog", or it can be the object relative, as in OO and SO types ". . . that the dog chased"; in both cases an antecedent must be determined. The absence of that, however, can result only in structures in which the first NP of two contiguous NPs is the object:

6.9 The duck bit the cat the dog chased. (OO)

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6.10 The cat the duck bit chased the dog. (SO)

One other factor which may facilitate the comprehension of SO types as opposed to OO types is the intonation contour, which in the case of type SO, provides a clear indication as to the clause boundary, correctly incorporating the relative clause before the first major drop in intonation, thereby supporting the complex subject NP analysis mentioned earlier.

All of these considerations point toward an interpretation in which the first NP is coded as the subject. An attempt has been made to show that the "object relatives" in the speech of two-year olds may not, in fact, be a relative clause structure per se; consequently, it is unlikely that a child would resort to the types of parsing strategies proposed for the adult normative data.

6.5 Interpretation of the Children's Results

In his discussion of possible strategies employed by children in language comprehension, Fluck (1977) suggests that the first strategy acquired can only cope with simplex sentences; it provides an interpretation for the first potential clause available and then breaks down (1977, p. 50). The second strategy, which he maintains children apply at about two years of age, when they are beginning to acquire complex structures, can begin to deal with embeddings, but then breaks down. According to his

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algorithm, the child codes the first NP as the topic:

> the topic is what the sentence is about, and it usually forms the grammatical subject. . .the hearer codes a topic NP as soon as possible and maintains a separate representation of this so that it is always available to interpret pronouns or complete clauses. (1977, p. 50)

The most critical stage of relative clause acquisition appears to be between the ages of seven and nine, where there is a rapid improvement in performance on SO types accompanied by a small improvement in performance on type OO, which suggests that at this stage, the child is attempting a variety of strategies in order to sort out the grammatical relations correctly (see Figures 1 and 2 below). He apparently tries the "easiest" strategies first, and only when they fail does he construct more complex ones. A plausible reason for the confounding might be that in these two cases, the relative clause has the internal structure [RP S V], which is quite distinct from the [S V O] structure characteristic of relatives with the relative pronoun as subject. The children might be taking the unique word order of the [RP S V] structures as indication of the fact that such structures <u>must</u> modify the main subject NP. If this incorrect strategy were actually employed by children in Age Group II, then performance on SO types should improve rapidly, with a simultaneous drop in performance on OO types. This is precisely what the data suggest. This erroneous interpretation is even more plausible when it is noticed that the word order [RP S V] is novel, providing the child with a word order clue for determining which NP the

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relative clause modifies, a clue which turns out to be a red herring.

Further evidence in support of this strategy comes from Quirk (1957), who has cited evidence that complete utterances containing subject relatives in spontaneous speech are less frequent than one might suppose, because nesting is a factor complicating production and perception. If, in fact, the majority of relative clause structures the child hears are object relatives, it is reasonable to assume that he will be relatively successful in imitating object relatives. Then, when the child begins to notice subject relatives, he may overgeneralize as follows: he may assume, on the basis of the object relatives, that all relatives must occur in sentence-final position, regardless of their antecedent. Consequently, in a production task, the child may make what Sheldon refers to as an extraposition error; yet, he will act out the task correctly, suggesting that he has comprehended the sentence correctly. Eventually (by ages nine or so) the child begins to sort out the correct relationships. Such an interpretation of the so-called object relatives lends a strong measure of support to the principle of functional expropriation, whereby new functions are first expressed by old structures.

To summarize the English children's results, it appears that the main strategy employed by the first age group was the non-interruption strategy, resulting in better performance on right-branching sentence types (OO and OS)

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than on center-embedded ones (SS and SO). Then, on the basis of subject relatives, the subjects start overgeneralizing as follows: they assume that all relatives must occur in sentence-final position, regardless of their antecedent. Consequently they start confusing the types OO and SO, both of which contain similar unique internal clause structures, namely [RP S V]. Evidence of the fact that the subjects are overgeneralizing the modification of the matrix subject NP is reflected in the fact that there is a drop in performance on OO types (with most of the errors of the SO type) accompanied by a sudden increase in performance on the SO types, which are interpreted correctly if the subjects overgeneralize subject modification. Eventually the subjects sort out the antecedents, and performance on all sentence types increases in the third group. A summary of the results is presented in Figure 6.1.

In summarizing the Ukrainian children's results, it appears that the main strategy employed by the first age group was the word order strategy, in which sentences containing the dominant SVO word order within the relative clause (OS and SS) were easier than sentences in which the relative clause contained a perturbation of the dominant word order (OO and SO). As with the children participating in the English study, performance on OO sentences increased slightly, accompanied by a great increase in the SO types. In fact, performance on type SO surpassed that of type OO in the second age group. The main errors on the OO types were

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Figure 6.1

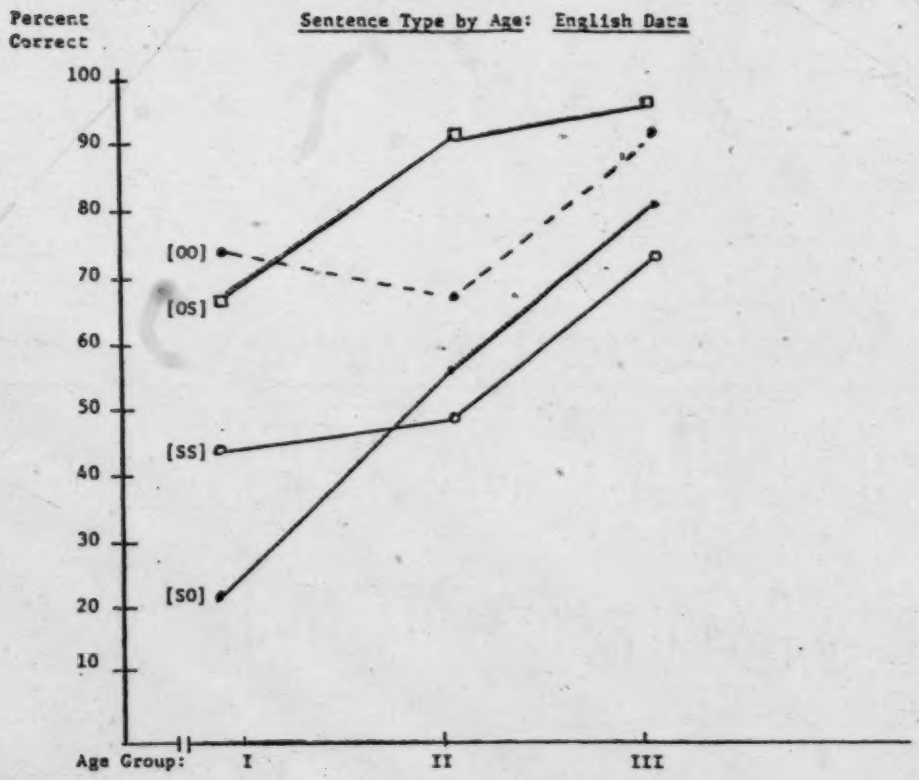
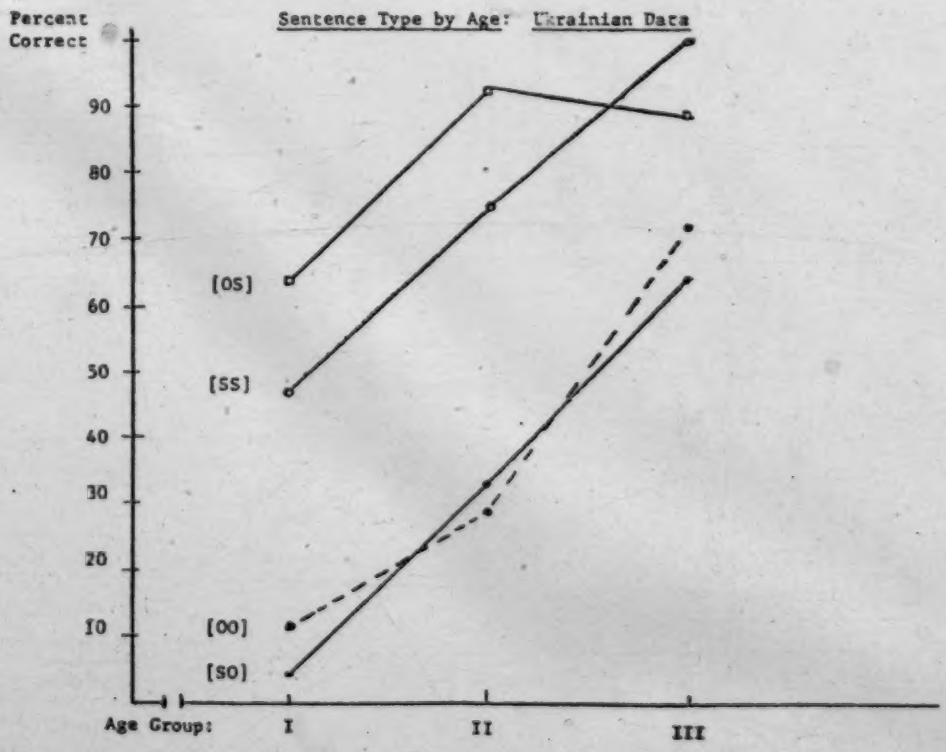


Figure 6.2



University of Alberta

SO errors and Adjacency errors, whereas the majority of the errors on the SO types were SS interpretations, indicating the application of the Conjoined Clause Analysis. Eventually the subjects sorted out the antecedents, and performance on all sentence types increased in the third age group. A summary of the results is presented in Figure 6.2.

It appears that the first age groups tended to interpret the structures 'locally', that is, at the clause level. Consequently, those clauses that violated the dominant SVO word order of both English and Ukrainian were found to be more difficult than those that retained the SVO word order in the relative clauses. The errors within the clause suggest that the subjects were interpreting the inverted word orders as instances of the standard word order, resulting in SVO interpretations within the embedded clauses. This also accounts for the SS interpretations on the SO types and the Adjacency errors on the OO types. The inverted word order within the relative clause, then, was a source of difficulty for the youngest subjects. The second age group was invoking a more global interpretation (at the sentence level), and as a result, misinterpreted the antecedent of the relative clauses. This led to a confounding of the OO and SO types within the second age group. Because of their over-reliance on the subject modification principle, they began making SO errors on OO sentence types, while performance improved rapidly on the SO types. Consequently, it is difficult to determine what

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percentage of the 'correct' responses in the second age group are, in fact, correct interpretations, and how many of the responses are essentially SO errors. Finally, performance on all four sentence types improved in the third age group. The first strategy, then, applied locally, and was operative mainly within the domain of the relative clause. The second age group began to interpret the sentences globally, which resulted in the erroneous selection of antecedents. The parsing strategy discussed in connection with the normative adult data accounts for the high scores on the OO types, because such a local analysis will correctly interpret the sequence -- NP (that) NP V -- as object-subject-verb for the reasons cited above. However, two sentence types contain this sequence -- namely, OO and SO. Why, then, was performance on the SO types so poor if the same local strategy should result in a correct interpretation on both types? The root of the problem seems to lie in the overall structure of the two sentence types, which the younger children did not take into consideration because they were applying the earlier (global or clausal) parsing strategies. In short, the matrix sentence of the OO type contains the SVO word order, which assists the child in achieving closure on the first proposition, which ends in an object. This matrix object is also the first NP of the second clause, which could easily be interpreted as subject of the second clause. A great number of the errors on the OO sentence types were, in fact, Adjacency interpretations, in

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which the object NP of the first clause was interpreted as the subject of the following clause. The only other strategy compatible with this interpretation of the results is one in which the object NP of the matrix clause is interpreted as the object of the relative clause -- not because the object NP and its antecedent share the same grammatical function, which is Sheldon's analysis of such errors, but rather because the local parsing strategy interprets the first occurrence of an NP in the sequence -- NP (that) NP V -- as an object, as argued above. The results, then, strongly support the Conjoined Clause Analysis and NVN Adjacency Analysis which are both predicated on the dominant linear word order of the languages tested, and consequently yield the correct responses to those structures conforming to the dominant word order of the language either at the local or global level. The SO strategy is applied when the global structure of the sentence is considered, for it takes into account the domain of the complete sentence in determining the antecedent. Finally, the results of the studies indicate that Sheldon's Parallel Function Hypothesis is not operative in any of the parsing strategies employed by the subjects. A summary of the strategies employed by the children in each age group is presented in Tables 6.1 and 6.2 .

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Table 6.1

Summary of the Strategies: English Data

Age Group	Main Strategies	Main Errors
I	(a)Non-Interruption (b)Adjacency Analysis	(a)Conjoined Clause Errors (b)Adjacency Errors
II	(a)Conjoined Clause Analysis (=First NP is Subject)	(a)Conjoined Clause Errors (b)Adjacency Errors (c)SO Errors
III	(a)Adjacency Analysis (b)Non-Interruption	(a)Adjacency Errors (b)Conjoined Clause Errors

Table 6.2

Summary of the Strategies: Ukrainian Data

Age Group	Main Strategies	Main Errors
I	(a)Word Order (b) (b)Conjoined Clause Analysis	(a) Conjoined Clause Errors (b) Adjacency Errors
II	(a) Word Order (b) (b) Conjoined Clause Analysis	(a)Adjacency Errors (b) Conjoined Clause Errors (c) SO Errors
III	(a)Word Order (b)	(a) Adjacency Errors (b) Conjoined Clause Errors

6.6 Implications of the Results

The discrepancies between the predictions and the results of the comprehension studies raise several issues which must be addressed.

Prideaux's (1979b) predictions regarding the order of emergence of relative clause structures in the speech of children are borne out by the acquisitional data. It was found that conjoined structures appeared in advance of embeddings and served as the structural model first used by the child, thereby lending a measure of support to the principles of cognitive precedence and functional expropriation. The data also revealed that object relatives were the first to appear, and that subject relatives were a source of difficulty for the child, supporting Slobin's principle of structural integrity. The actual acquisitional evidence does, then, support the theoretical predictions formulated along developmental lines. Sheldon (1972) also predicted that subject relatives would be learned later than object relatives "because they are self-embedded and/or because subject complexity seems to be more difficult" (p. 17). In so doing, Sheldon provides a circular argument for complexity, for she defines complexity by order of emergence. Furthermore, if object relatives are, in fact, psychologically less complex, then one would expect that they would be more easily comprehended than subject relatives; yet, on the basis of the results obtained from the comprehension experiments, ease of comprehension appears

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to be determined by the function of the relativized NP rather than by the location of the relative clause. The results of the comprehension studies, then, indicate that the order of emergence does not reflect the order of ease of comprehension.

The preponderance of evidence, then, suggests that object relatives are more common in the speech of both adults and children because they are less difficult perceptually and productively (Quirk, 1957; Limber, 1973). Yet it is difficult and disturbing to argue for a universal of language processing on the basis of frequency, unless frequency can itself be explained by naturalness or psychological simplicity, for instance. That is, are subject relatives avoided in speech because they are more difficult and/or less natural than object relatives? If so, why are the less 'natural' and more difficult subject relatives more easily comprehended? Schlesinger (1968) has suggested that the scarcity of complex self-embedded sentences in everyday usage is due not to decoding difficulties, but to encoding difficulties, in which short term memory limits more readily break down than in decoding. This would imply that comprehension exceeds production and possibly the issue here is one of production versus comprehension, or comprehension versus acquisition, or both.

These observations suggest that we may be confounding acquisitional and comprehension data unjustifiably. The predictions based on developmental principles about the

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emergence of relatives were substantiated by empirical data. With the comprehension data, however, we must take into account the age differential of the subjects and consequently the different strategies that are being used. As pointed out by Bever (1970), strategies change with age and with increasing linguistic sophistication. Are we then justified in using principles derived from the acquisitional data of two year olds to assess the comprehension results of linguistically more sophisticated seven year old speakers and vice versa? Furthermore, is comprehension an accurate or complete measure of linguistic competence? By equating the two concepts of comprehension and competence Sheldon may be confounding them. She set out to study general developmental trends in children vis a vis relative clause acquisition, and then proceeded to draw generalizations about language-independent processing heuristics on the basis of comprehension data. It is questionable whether Sheldon was justified in equating comprehension with acquisition or competence (and production with performance) as she did implicitly. She stated that her comprehension tests were an attempt at getting at competence, and claimed that comprehension is closer to competence than is production (1974, p. 274). In practice, however, comprehension and production were equated because she compared acquisitional data (spontaneous production data) with the results of comprehension studies. Others would take a nearly opposite approach in child language studies, judging competence on

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the basis of a corpus (=production). As Connors (1976) points out in a review of Kessler (1974):

> Are we to leave competence as a mystic indefinable? Are we to equate it with comprehension? In either of these cases the term competence is useless, and we would do better to talk about comprehension when that is what we are testing. (p. 417)

A more fundamental question which should be addressed is the role of comprehension in language acquisition. The theoretical significance of the distinction between comprehension and production is often overlooked and often confounded with the distinction between competence and performance. If we describe competence as the knowledge of linguistic categories, etc., that accounts for a native speaker's intuitions about his language, and performance as the realization or expression of competence through speaking and listening, then it follows that production and comprehension are both aspects of linguistic performance, since both involve the utilization of competence. A great deal of work is necessary in the clarification of the difference between production and comprehension, for this distinction occupies an important position in studies of language acquisition. Some research has suggested that a child's own production of speech will not be critically involved in the process of language acquisition (Miller, 1966). Moreover, we can obtain more information from comprehension than production studies, according to Brown and Bellugi (1968). In a comprehension task we know something about the nature of the input, but in production

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we have no way of knowing, since the input (e.g., the child's intended message) is totally obscure (p. 42). We must, however, be cautious about becoming overly zealous in overestimating the extent of our knowledge of what the input to the child really is, because what the child hears is not necessarily what he learns or even attends to. In short, we must distinguish between input and intake, for we have no way of knowing what features of adult speech the child is attending to and to what extent he benefits from the modifications found to be characteristic of adult speech to children (e.g., , Snow, 1972). In general, though, children do appear to profit from the well-formed utterances that are presented by parental speech, which implies that the child's linguistic competence develops through his comprehension. As pointed out by McNeill (1966), the study of comprehension may prove to be the principal avenue through which a child acquires language, and the problem of how children comprehend language may be inseparable from the problem of how they acquire it.

University of Alberta

6.7 Suggestions for Further Research

The paucity of relative clause structures in the speech of children makes it difficult to assess competing hypotheses about psychological complexity, the effect of word order, interruption, and the like as operative in spontaneous speech. The heavy reliance on naturalistic observations has led to the postulation of claims about

language acquisition which are open to serious question, since in many cases the evidence is based on a small sample of children who are, to make matters worse, usually precocious.[14] Therefore, it is questionable whether such data provide a valid basis on which to draw general conclusions about the process of language acquisition. Furthermore, it is doubtful whether fragmentary structures such as those provided by Limber should be used as evidence of the fact that the child is capable of producing relative clause structures in spontaneous speech.

As mentioned above, the scarcity of relative constructions in spontaneous speech makes it difficult to assess the competing predictions about the emergence of relative clause structures in the speech of children. One possible means of increasing the frequency of relative clauses in natural speech would be to conduct an experiment in which the child is instructed to describe some act or procedure, for example, where he would have greater potential for using noun phrase modification. In any event, more experimentation is warranted on the spontaneous production of relative clauses.

An unexpected result of the research reported here was the fact that there was no significant variation in the number of correct responses at any particular age. The absence of statistically significant type by age interactions could be interpreted to mean that there are no

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[14]Limber's evidence is based on a subject whose parents were both college graduates.

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wide differences across ages, and that chronological age is as reliable an indicator of linguistic progress as are the linguistically internal measures in this study.

In the study conducted by Prideaux et al. (1979), in which adults were asked to make naturalness judgements of sentences containing relative clauses in both active and passive voices, it was found that within the actives, interruption was found to be the only factor differentiating groups. Of the actives, OO and OS were judged significantly more natural than types SO and SS, (F,(1,119)=12.05, p < 0.001). The relative order of naturalness was found to be: OS, OO > SO, SS. This order differs from the results of the normative data analyzed in this study (i.e., Experiments 3 and 4). The differences may, in fact, be an artifact of the different experimental techniques employed. The lexical items in the experiments reported here were carefully controlled, and the sentences conatained only relative clauses in the active voice. In the experiment conducted by Prideaux et al. (1979), the relative clauses were cast in both active and passive voices. On the one hand, the passive sentences may have acted as distractors, but on the other, the great variety of lexical items and syntactic structures incorporated in the stimulus sentences may have contributed to the confounding of pragmatic considerations with structural ones. The main effect of subjects was found to be highly significant in both studies, suggesting that subjects were responding to the stimulus sentences in different ways.

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A more tightly constrained experiment might be possible in which the lexical items are controlled for frequency and imagery, in order to eliminate the effect of lexical, semantic, and pragmatic considerations . A technique that might prove more accurate in measuring the processing difficulty of the relative clause structures is one in which the stimulus sentences are presented aurally. Such a technique would force subjects to rely on memory, thereby eliminating the possibility of analyzing written stimuli and thus providing a more accurate measure of comprehension under memory limitations. Another means of controlling the possible responses would be by presenting the stimulus sentences in context and controlling the discourse in such a way that all subjects were provided with the same contextual information. This would avoid a purely sentence-bound analysis.

After participating in the two experiments described in this dissertation, the adults' major complaint was that some of the sentences were "too unnatural" to rate. This is one of the serious inadequacies of a sentence-bound analysis such as those used in these experiments and also in Prideaux et al. (1979). The acquisition and comprehension of language involves more than sentences in isolation. The child acquiring language is exposed to various syntactic structures presented in context, and can thus draw on cognitive abilities and perceptual cues beyond the structural aspects of the utterances he is acquiring.

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Consequently, his comprehension abilities should be tested in a similar fashion -- namely, in context. It is quite likely that many of the sentences that the adults found "highly unnatural" would have been more "natural" had they been presented within some appropriate context.

Further research in this general area could build upon the results reported here, but it could obviously extend the investigation both methodologically, by utilizing new techniques, and linguistically, by incorporating context, and excercising lexical controls.

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6.8 Conclusions

We set out to investigate the evidence for three important hypotheses which have been postulated for language processing -- namely, the Interruption, Word Order, and Parallel Function Hypotheses. The results of the normative data from adults are identical in both English and Ukrainian, indicating that word order is the main factor separating the four syntactic types examined. The relative ease of comprehension from easiest to hardest is: OS,SS > SO > OO. The results of the English study with children indicates that interruption is the main factor affecting performance, thereby paralleling the findings of the normative data reported by Prideaux et al. (1979). The results of the study with Ukrainian-speaking bilingual children indicate that word order is the main factor affecting performance. Therefore, the results of the

normative data obtained from both native adult speakers of English and Ukrainian in this study support the results of the comprehension study conducted with Ukrainian children. Word order, then, overrides the morphological cues supplied by the inflectional endings in Ukrainian. Although the factors affecting comprehension in both English and Ukrainian children appear to differ, an examination of the errors committed by both groups reveal a great similarity in strategies. Both groups of children tend to depend on the linear order of constituents. The main aspect of word order which facilitates comprehension is the position of the subject with respect to the object, with a preference for S-O sequences. The tendency for relative clauses with a perturbation of the dominant word order was to interpret such structures as instances of the dominant SVO word order, in which the first NP was interpreted to be the subject. Another common problem in both groups was determining an antecedent for the relative pronoun of the relative clause. The sets of evidence from English and the parallel facts from Ukrainian together suggest that relative clause structures are interpreted (parsed) in terms of their superficial form, although lexical and pragmatic considerations possibly enter to facilitate some aspects of parsing. These findings suggest that functional surface oriented models of syntactic description are closer to providing insights into the way language acquisition and comprehension work than are models which place little

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emphasis on either functions or surface structures.

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APPENDIX A

Test Sentences Used in the Relative Clause Comprehension Task

Experiment 1

Subject relatives: subject fronted (SS):

1. The rabbit that touched the dog pushed the chick.
2. The monkey that pushed the duck hit the dog.
3. The dog that pushed the cat touched the horse.

Subject relatives: object fronted (SO):

1. The horse that the dog kicked pushed the duck.
2. The chick that the duck bumped touched the cat.
3. The rabbit that the chick hit jumped over the dog.

Object relatives: subject fronted (OS):

1. The monkey pushed the rabbit that hit the duck.
2. The dog touched the monkey that pushed the chick.
3. The mouse pushed the chick that bit the dog.

Object relatives: object fronted (OO):

1. The dog jumped over the horse that the rabbit pushed.
2. The mouse pushed the duck that the bird hit.
3. The chick bit the cat that the mouse pushed.

Conjoined clauses:

1. The dog pushed the cat and the dog touched the horse.
2. The mouse pushed the chick and the chick bit the dog.
3. The dog jumped over the horse and the rabbit pushed the horse.

Filler Sentences:

1. Can you make the dog jump over the duck?
2. The dog pushed the chick and then he bit the cat.
3. Make the cat push the mouse off the table.

APPENDIX B

Test Sentences Used in the Relative Clause Comprehension Task

Experiment 2

Subject relatives: subject fronted (SS): [SVO Word Order in Relative Clause]

1. Коник, що б'є песика, пхає качку.
2. Мавпа, що пхає коника, б'є мишку.

Subject relatives: subject fronted (SS): [SOV Word Order in Relative Clause]

1. Песик, що мишку б'є, пхає коника.
2. Мавпа, що качку пхає, скаче через коня.

Subject relatives: object fronted (SO): [OSV Word Order in Relative Clause]

1. Песик, що його качка пхає, кусає мавпу.
2. Мавпа, що її курчатко пхає, кусає качку.

Subject relatives: object fronted (SO): [OVS Word Order in Relative Clause]

1. Песик, що його кусає кінь, пхає мавпу.
2. Мавпа, що її б'є песик, кусає коня.

Object relatives: subject fronted (OS): [SVO Word Order in Relative Clause]

1. Песик пхає качку, що б'є коника.
2. Коник кусає мавпу, що пхає песика.

Object relatives: subject fronted (OS): [SOV Word Order in Relative Clause]

1. Песук пхає качку, що коня б'є.
2. Коник б'є мавпу, що песика кусає.

Object relatives: object fronted (OO): [OSV Word Order in Relative Clause]

1. Качка кусає пса, що його кінь пхає.
2. Мишка кусає пса, що його кінь б'є.

Object relatives: object fronted (OO): [OVS Word Order in Relative Clause]

1. Песик кусає курчатко, що його пхає мишка.
2. Кінь пхає мавпу, що її кусає качка.

APPENDIX C

This study is being conducted in order to obtain normative data on the relative ease of comprehension of certain sentence types. By ease of comprehension I mean: would one sentence be harder to understand or take slightly longer to understand than another. Read through all the sentences before beginning, in order to get a general impression of differences in difficulty. Then, read each pair of sentences abd decide which is easier . Indicate your choice in the following manner:

1a.
~~b.~~

Then consider each of the sentences and rate them on a '9'-point rating scale by circling your choice, reserving the lower end of the scale for those sentences which seem to be easier to understand, and reserving the upper end of the scale for those sentences that seem more difficult. Please feel free to use the entire range of the scale during the experiment. On the other hand, don't be concerned if you find you are using some numbers more than others.

Easiest Most difficult
1 2 3 4 5 6 7 8 9

Your ratings should reflect the magnitude of the difference in ease of comprehension relative to the other sentence of the pair. For example, if two sentences are both quite easy, choose the easier of the two and assign it a score by circling the appropriate number on the rating scale:

1 2 (3) 4 5 6 7 8 9

Then consider the other sentence and give it a rating which reflects its relative degree of ease of comprehension with respect to the other one. The following would be an example of a set of sentences in which both are quite easy, with a relatively small difference in the degree of ease between them:

~~a.~~ (1) 2 3 4 5 6 7 8 9
b. 1 (2) 3 4 5 6 7 8 9

IMPORTANT: THE SENTENCE YOU CHOOSE WITHIN EACH PAIR SHOULD NECESSARILY HAVE THE LOWER RATING ON THE RATING SCALE.

1a. The rabbit that touched the dog pushed the chick. 1 2 3 4 5 6 7 8 9
b. The dog that bumped the cow touched the rabbit. 1 2 3 4 5 6 7 8 9

2a. The dog pushed the chick that touched the horse. 1 2 3 4 5 6 7 8 9
b. The dog that the chick pushed touched the horse. 1 2 3 4 5 6 7 8 9

3a. The monkey pushed the duck that the dog touched. 1 2 3 4 5 6 7 8 9
b. The monkey that pushed the duck touched the dog. 1 2 3 4 5 6 7 8 9

4a. The duck jumped over the monkey that bumped the bird. 1 2 3 4 5 6 7 8 9
b. The monkey jumped over the horse that pushed the chick. 1 2 3 4 5 6 7 8 9

5a. The rabbit that the dog touched pushed the monkey. 1 2 3 4 5 6 7 8 9
b. The rabbit that touched the dog pushed the monkey. 1 2 3 4 5 6 7 8 9

6a. The dog that pushed the horse touched the duck. 1 2 3 4 5 6 7 8 9
b. The dog pushed the horse that the duck touched. 1 2 3 4 5 6 7 8 9

7a. The horse that the monkey pushed touched the mouse. 1 2 3 4 5 6 7 8 9
b. The dog that the rabbit bumped touched the bird. 1 2 3 4 5 6 7 8 9

8a. The monkey that the dog pushed bumped the duck. 1 2 3 4 5 6 7 8 9
b. The monkey pushed the dog that bumped the duck. 1 2 3 4 5 6 7 8 9

9a. The cat pushed the dog that the monkey bumped. 1 2 3 4 5 6 7 8 9
b. The cat that the dog pushed bumped the monkey. 1 2 3 4 5 6 7 8 9

10a. The cat bit the duck that the dog hit. 1 2 3 4 5 6 7 8 9
b. The chick bit the horse that the duck bit. 1 2 3 4 5 6 7 8 9

11a. The monkey that pushed the rabbit hit the duck. 1 2 3 4 5 6 7 8 9
b. The monkey pushed the rabbit that hit the duck. 1 2 3 4 5 6 7 8 9

12a. The dog that bit the chicken pushed the duck. 1 2 3 4 5 6 7 8 9
b. The cat that pushed the duck hit the man. 1 2 3 4 5 6 7 8 9

13a.	The dog touched the horse that the mouse bit.	1 2 3 4 5 6 7 8 9
b.	The dog touched the horse that bit the mouse.	1 2 3 4 5 6 7 8 9
14a.	The horse that the dog touched pushed the cow.	1 2 3 4 5 6 7 8 9
b.	The horse that touched the dog pushed the cow.	1 2 3 4 5 6 7 8 9
15a.	The dog pushed the monkey that the duck touched.	1 2 3 4 5 6 7 8 9
b.	The chick hit the duck that the dog pushed.	1 2 3 4 5 6 7 8 9
16a.	The dog pushed the duck that the chick bit.	1 2 3 4 5 6 7 8 9
b.	The dog pushed the duck that bit the chicken.	1 2 3 4 5 6 7 8 9
17a.	The monkey that touched the dog pushed the cat.	1 2 3 4 5 6 7 8 9
b.	The monkey touched the dog that pushed the cat.	1 2 3 4 5 6 7 8 9
18a.	The duck that the dog hit pushed the monkey.	1 2 3 4 5 6 7 8 9
b.	The dog that the monkey hit touched the cat.	1 2 3 4 5 6 7 8 9
19a.	The mouse hit the duck that the cat pushed.	1 2 3 4 5 6 7 8 9
b.	The mouse that the duck hit pushed the cat.	1 2 3 4 5 6 7 8 9
20a.	The monkey pushed the dog that hit the chicken.	1 2 3 4 5 6 7 8 9
b.	The chicken touched the mouse that pushed the dog.	1 2 3 4 5 6 7 8 9

APPENDIX D

This study is being conducted in order to obtain normative data on the relative ease of comprehension of certain sentence types. By ease of comprehension I mean: would one sentence be harder to understand or take slightly longer to understand than another. Read through all the sentences before beginning, in order to get a general impression of differences in difficulty. Then, read each pair of sentences abd decide which is easier . Indicate your choice in the following manner:

1a.
~~b.~~

Then consider each of the sentences and rate them on a '9'-point rating scale by circling your choice, reserving the lower end of the scale for those sentences which seem to be easier to understand, and reserving the upper end of the scale for those sentences that seem more difficult. Please feel free to use the entire range of the scale during the experiment. On the other hand, don't be concerned if you find you are using some numbers more than others.

Easiest Most difficult
1 2 3 4 5 6 7 8 9

Your ratings should reflect the magnitude of the difference in ease of comprehension relative to the other sentence of the pair. For example, if two sentences are both quite easy, choose the easier of the two and assign it a score by circling the appropriate number on the rating scale:

1 2 (3) 4 5 6 7 8 9

Then consider the other sentence and give it a rating which reflects its relative degree of ease of comprehension with respect to the other one. The following would be an example of a set of sentences in which both are quite easy, with a relatively small difference in the degree of ease between them:

~~a.~~ (1) 2 3 4 5 6 7 8 9
b. 1 (2) 3 4 5 6 7 8 9

IMPORTANT: THE SENTENCE YOU CHOOSE WITHIN EACH PAIR SHOULD NECESSARILY HAVE THE LOWER RATING ON THE RATING SCALE.

1a. Мавпа, що коника б'є, пхає мишку. 1 2 3 4 5 6 7 8 9
b. Качка кусає пса, що його б'є коник. 1 2 3 4 5 6 7 8 9

2a. Качка, що б'є мавпу, скаче через коника. 1 2 3 4 5 6 7 8 9
b. Коник б'є мавпу, що песика кусає. 1 2 3 4 5 6 7 8 9

3a. Котик пхає курчатко, що його б'є пес. 1 2 3 4 5 6 7 8 9
b. Котик пхає мавпу, що коника кусає. 1 2 3 4 5 6 7 8 9

4a. Пес, що його кусає коник, б'є мавпу. 1 2 3 4 5 6 7 8 9
b. Коник, що б'є пса, пхає качку. 1 2 3 4 5 6 7 8 9

5a. Качка кусає курчатко, що його качка пхає. 1 2 3 4 5 6 7 8 9
b. Песик пхає качку, що б'є коника. 1 2 3 4 5 6 7 8 9

6a. Мавпа, що її качка б'є, пхає коника. 1 2 3 4 5 6 7 8 9
b. Котик, що його пхає мавпа, кусає пса. 1 2 3 4 5 6 7 8 9

7a. Курчатко, що пхає качку, б'є мавпу. 1 2 3 4 5 6 7 8 9
b. Песик кусає курчатко, що його б'є мишка. 1 2 3 4 5 6 7 8 9

8a. Мавпа, що її б'є пес, кусає коника. 1 2 3 4 5 6 7 8 9
b. Мишка кусає пса, що його коник б'є. 1 2 3 4 5 6 7 8 9

9a. Мавпа, що котика кусає, б'є качку. 1 2 3 4 5 6 7 8 9
b. Пес скаче через мавпу, що кусає котика. 1 2 3 4 5 6 7 8 9

10a. Песик пхає качку, що б'є коника. 1 2 3 4 5 6 7 8 9
b. Песик, що його коник пхає, кусає мавпу. 1 2 3 4 5 6 7 8 9

11a. Песик, що мишку б'є, пхає коника. 1 2 3 4 5 6 7 8 9
b. Качка б'є мавпу, що її коник пхає. 1 2 3 4 5 6 7 8 9

12a. Коник б'є мавпу, що пса кусає. 1 2 3 4 5 6 7 8 9
b. Качка, що її коник пхає, кусає мавпу. 1 2 3 4 5 6 7 8 9

13a. Мавпа, що б'є качку, скаче через коня. 1 2 3 4 5 6 7 8 9
b. Мавпа, що котика пхає, б'є качку. 1 2 3 4 5 6 7 8 9

14a. Качка, що її мавпа пхає, б'є пса. 1 2 3 4 5 6 7 8 9
b. Мавпа, що котика пхає, кусає пса. 1 2 3 4 5 6 7 8 9

15a. Пес кусає мишку, що її пхає качка. 1 2 3 4 5 6 7 8 9
b. Мавпа, що її б'є качка, пхає коника. 1 2 3 4 5 6 7 8 9

16a. Пес скаче через мавпу, що кусає коня. 1 2 3 4 5 6 7 8 9
b. Мавпа, що її кусає коник, пхає качку. 1 2 3 4 5 6 7 8 9

17a. Качка, що мавпу кусає, б'є курчатко. 1 2 3 4 5 6 7 8 9
b. Коник пхає мавпу, що пса кусає. 1 2 3 4 5 6 7 8 9

18a. Качка кусає курчатко, що його пхає мишка. 1 2 3 4 5 6 7 8 9
b. Мавпа, що її пес пхає, кусає коня. 1 2 3 4 5 6 7 8 9

19a. Пес пхає качку, що б'є коня. 1 2 3 4 5 6 7 8 9
b. Качка пхає пса, що його кусає курчатко. 1 2 3 4 5 6 7 8 9

20a. Курчатко, що кусає мавпу, пхає коня. 1 2 3 4 5 6 7 8 9
b. Качка, що її пхає пес, б'є мавпу. 1 2 3 4 5 6 7 8 9

21a. Качка кусає мавпу, що пса пхає. 1 2 3 4 5 6 7 8 9
b. Пес, що його пхає курчатко, скаче через мавпу. 1 2 3 4 5 6 7 8 9

22a. Мавпа, що пхає кота, кусає коня. 1 2 3 4 5 6 7 8 9
b. Коник скаче через пса, що пхає кота. 1 2 3 4 5 6 7 8 9

23a. Пес, що мавпу б'є, кусає качку. 1 2 3 4 5 6 7 8 9
b. Кінь, що його кусає курчатко, пхає пса. 1 2 3 4 5 6 7 8 9

24a. Мавпа скаче через курчатко, що його качка пхає. 1 2 3 4 5 6 7 8 9
b. Качка б'є мавпу, що її пхає пес. 1 2 3 4 5 6 7 8 9

25a. Кінь, що б'є пса, пхає качку. 1 2 3 4 5 6 7 8 9
b. Качка б'є мавпу, що її кінь пхає. 1 2 3 4 5 6 7 8 9

26a. Мавпа кусає пса, що його кінь пхає. 1 2 3 4 5 6 7 8 9
b. Мавпа, що її качка кусає, пхає коня. 1 2 3 4 5 6 7 8 9

27a. Кіт пхає мавпу, що кусає коня. 1 2 3 4 5 6 7 8 9
b. Мавпа кусає коня, що курчатко пхає. 1 2 3 4 5 6 7 8 9

28a. Кіт пхає мавпу, що коня кусає. 1 2 3 4 5 6 7 8 9
b. Мишка кусає пса, що його кінь б'є. 1 2 3 4 5 6 7 8 9